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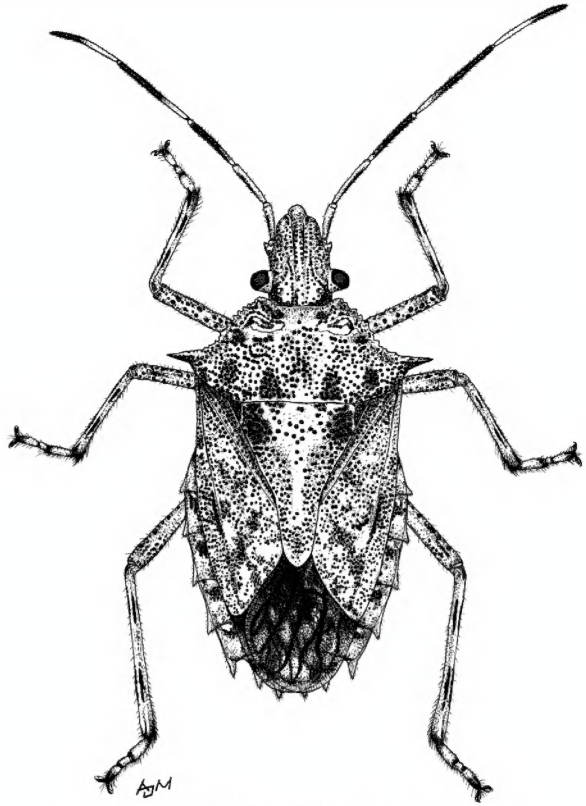

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COVER

Bromocoris souefi (Distant, 1910) (Hemiptera: Pentatomidae) was described by British hemipterist, W.L. Distant, from a specimen collected at Cooktown in 1896 by W.H.D. Le Souëf after whom it is named. He was son of the Director of the Melbourne Zoo and collected it on an expedition to collect tree kangaroos for the zoo. It occurs in Indonesia, New Guinea and northern Australia. Its range in Australia has recently expanded southerly and it has been common in Brisbane since 2006. Females brood and vigorously guard their eggs and first instars on the undersides of leaves of many tree species. The illustration is ink on paper by ESQ member Dr Andrew Maynard who received his UQ PhD in 2020 on the invasion history and evolution of *Aedes albopictus* and *Aedes aegypti* in the Indo-Pacific. He works in Brisbane at the Dept. of Agriculture, Water and the Environment as a biosecurity entomologist with special interest in Hemiptera. *Bromocoris souefi* is routinely intercepted.

THE DISTRIBUTION AND ECOLOGY OF THE SOUTHERN PINK UNDERWING MOTH *PHYLLODES IMPERIALIS SMITHERSI* SANDS (LEPIDOPTERA: EREBIDAE) IN NEW SOUTH WALES

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Abstract

The distribution, ecology and conservation status of the Southern Pink Underwing Moth *Phyllodes imperialis smithersi* Sands and its larval food plant Carronia Vine *Carronia multisepalea* F. Muell. was investigated in New South Wales (NSW) from 2016 to 2021. The moth is listed as Endangered by the Australian and NSW governments. *Phyllodes imperialis smithersi* and its specific food plant were found in two disjunct regions; the Northern Rivers and Bellinger-Orara. *Carronia multisepalea* occurred in subtropical rainforest, was common in the Northern Rivers but patchily distributed in the Bellinger-Orara region. *Phyllodes imperialis smithersi* was surveyed by searching the food plant for eggs and larvae. Although considered to be very rare at the commencement of this study, *P. i. smithersi* was found at 48% of sites containing *C. multisepalea* and across the geographic and environmental range of the food plant. Larvae were located at a mean height of 61 cm, on younger leaves (81% from the current season) in low light situations (62% canopy cover) and 5–790 m above sea level. In the Northern Rivers, *P. i. smithersi* was found in major tracts of forest (McPherson Range, Wollumbin and Nightcap) and in 20 smaller remnants. We estimated 34,055 ha of potential habitat in the region and consider *P. i. smithersi* to be currently secure in the Northern Rivers. In the disjunct Bellinger-Orara region, *P. i. smithersi* was found in nine new locations, with abundant larvae and host plants at some sites. In many areas, rainforest appeared to be regenerating from past disturbance, with intact canopies beginning to provide suitable breeding conditions for the moth. However, the potentially isolated Bellinger-Orara population of *P. i. smithersi* remains relatively limited in extent and increasingly threatened from intense drought and fire.

Keywords: invertebrate conservation, endangered species, Australian moths

Introduction

Moths in the genus *Phyllodes* Boisduval occur in many tropical regions north of Australia and on islands of the Pacific. In Australia, *P. imperialis* is a large moth (with a wingspan up to 12 cm) that is represented by two subspecies. The Northern Pink Underwing Moth *P. i. meyricki* Olliff occurs in northeastern Queensland and the Southern Pink Underwing Moth *P. i. smithersi* Sands (Fig. 1) in southeastern Queensland and northeastern NSW (Sands 2012a). The larvae of *P. imperialis* are well known for their dramatic warning display (Hunter 1939) (Fig. 2).

Phyllodes spp. are taxonomically related (Zahiri *et al.* 2010) to fruit piercing moths (e.g. *Eudocima* Billberg spp.). Adults of *Phyllodes* spp. and *Eudocima* spp. often share the leaf mimicry of forewings and bright colouration of hindwings. Adult fruit piercing moths are capable of piercing firm fruit with the barbed apices of their proboscis (Sands and Liebregts 2005). In contrast, *Phyllodes* and many other non-piercing genera, known as fruit sucking moths, are without sclerotized apices and instead have fine setae on the apex of the proboscis. Fruit sucking moths feed on rotting or damaged fruit (Sands 1999, 2012b) that is still hanging (Fig. 3).

The larvae of *Phyllodes* spp. and many fruit piercing moths favour vines of the family Menispermaceae as food plants (Zahiri *et al.* 2010), having adapted to feed on alkaloids present in the leaves (Fay 1996). *Phyllodes* spp. and *Eudocima* spp. are often host-plant specific. The larvae of *P. i. meyricki* feed on the tropical vine *Pycnarrhena novoguineensis* Miquei and larvae of *P. i. smithersi* feed only on *Carronia multisepalea* F. Muell. (Sands 2012a). The fruit piercing moth *Eudocima fullonia* Clerck also uses *C. multisepalea* as one of its larval food plants. This rainforest vine is known to occur from near Gympie in Queensland to Bellingen in NSW. Mature *C. multisepalea* can be very large vines with multiple stems and foliage in the rainforest canopy. Shoots arising from underground rhizomes can also be common across the rainforest floor, although these are likely to be suppressed until there is an opportunity to exploit a gap in the canopy. The vine can grow profusely in gaps and edges of rainforest.

Phyllodes imperialis smithersi was listed nationally as Endangered in 2002 (Threatened Species Scientific Committee 2002), when it was known from only four locations in South East Queensland and an outlying location over 300 km south in NSW in Dorrigo National Park (NP). Two specimens (1973, 1990) from this reserve were lodged with the Australian National Insect Collection, CSIRO Canberra. When Sands (2012a) described *P. i. smithersi*, there were only eight sites known in Queensland (including the northern range limit at Kin Kin Creek near Gympie, Conondale Range, Mary Cairncross Scenic Reserve, Blackall Range, D'Aguilar Range, Springbrook, Currumbin Valley and the Lamington Plateau) and seven in NSW (in the Northern Rivers region and the isolated southern range limit at Bellingen (Britton 2006)). The southern subspecies was considered Critically Endangered by Clark and Spier-Ashcroft (2003) and was listed as Endangered in NSW in 2003 (NSW Scientific Committee 2003).

Adult *P. i. smithersi* are not strongly attracted to light and rarely caught in light traps (Sands, in Roads and Maritime Services 2013). Lachlan (2014) conducted many nights of light-trapping over several years within the habitat of the moth for only four captures, all on one night. Also, at Coolgardie, no adult moths were observed at fruit baits deployed in habitat known to be occupied by the species (Lloyd *et al.* 2019). Due to the difficulty of surveying adult moths, the larval stage was the focus of this study. We (i) recorded the distribution and abundance of *C. multisepalea* in rainforest remnants in NSW, (ii) investigated the distribution, ecology and abundance of *P. i. smithersi* larvae, (iii) recorded habitat characteristics at each location where *P. i. smithersi* was found, and (iv) noted potential threats and possible management responses.

Methods

Rainforest survey sites were selected to encompass the geographic and altitudinal range of *C. multisepalea*, the largest rainforest remnants and a representative sample of small remnants. Potential survey sites were identified using NSW BioNet records of *C. multisepalea*, vegetation mapping, aerial imagery and

Figs 1–3. The Southern Pink Underwing Moth *Phyllodes imperialis smithersi*: (1) a male collected (as a larva) by D.P.A. Sands in 1988 at Mary Cairncross Scenic Reserve, Maleny, QLD and held in the Australian National Insect Collection (CSIRO) Canberra; (2) the warning display of the fifth instar larva (Photo: P.G. Richards); (3) an adult moth interrupted while feeding on damaged fruit of the introduced Rose Apple *Syzygium jambos* (L.) Alston, and flashing its pink hindwing as a warning—the forewing camouflage is also illustrated, resembling a leaf or bark, including insect scars (Photo: M.S. Graham).

topographic mapping. Sites on public land were most accessible and logistically efficient to survey, although several private properties were also surveyed. *Phyllodes imperialis smithersi* and *C. multisepalea* occur in two coastal regions: the Northern Rivers region (north of the Richmond River and centred on the rainforests of the Mount Warning caldera and 'Big Scrub' remnants) and the Bellinger-Orara region (Fig. 4).

At each site, a search for *C. multisepalea* was conducted and the duration recorded. When *C. multisepalea* was found, a timed search was carried out for *P. i. smithersi* larvae and eggs. Searches involved an inspection of leaves (particularly undersides) and stems of all plants within the immediate area. Vines were searched thoroughly to a height of 2.5 m. Above that height, binoculars were used to inspect vines where possible; canopy foliage was rarely seen and therefore not surveyed. Data recorded at each site were: (i) time searching for *C. multisepalea*, (ii) number, height and age class of vines, (iii) presence of old or freshly browsed leaves, (iv) time searching for *P. i. smithersi* larvae, (v) number and instar of larvae, (vi) age class of leaves eaten by larvae, (vii) height of larvae above ground, (viii) number of eggs, (ix) vegetation type, and (x) percentage crown cover of overstorey.

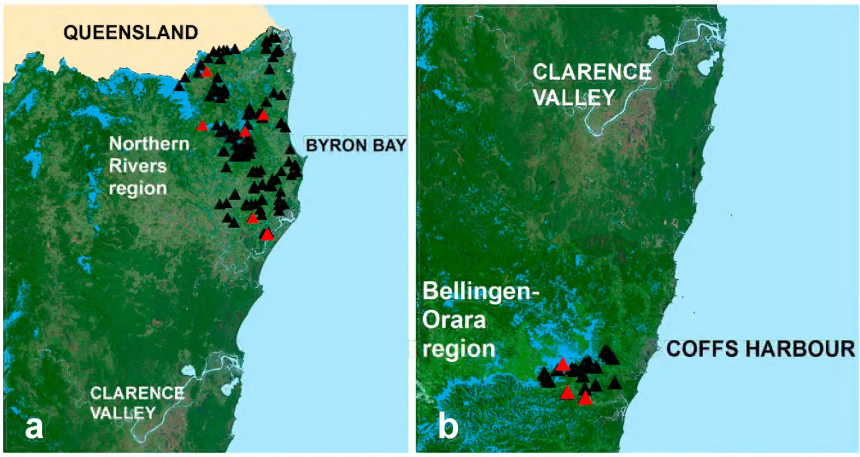

Fig. 4. The two disjunct *Phyllodes imperialis smithersi* populations in northern NSW, defined by the distribution of its larval food plant *Carronia multisepalea* (black triangles, from the NSW BioNet) and the nine locations of *P. i. smithersi* known prior to this study (red triangles): (a) Northern Rivers; (b) Bellinger–Orara. The disjunction between them tracks the pattern of the distribution of coastal rainforest (blue).

A broad assessment of the extent of potential *P. i. smithersi* habitat in NSW was obtained from the extent of subtropical rainforest mapping (Office of Environment and Heritage 2010) in the catchments containing *P. i. smithersi* and *C. multisepalea* records.

Results

Between 28 November 2016 and 26 March 2021 (five seasons), 143 sites were surveyed over 64 days. *Carronia multisepalea* was recorded at 130 sites (91% of those surveyed), although many of these sites were targeted for survey because they were known to contain the vine. An average of 22 vines were located per site; 15 young vines, 6 intermediate vines and 0.4 old vines (it is likely that many of the 'young' and 'intermediate' vines emerge from underground rhizomes, so this is not a count of different plants, but different stems). Of the sites where *C. multisepalea* was recorded, 92% exhibited old browse scars on the leaves and 60% had fresh scars (not necessarily from *P. i. smithersi*).

A total of 395 *P. i. smithersi* larvae were recorded at 61 sites and 132 eggs at 16 sites (Table 1). Eggs were recorded at two sites (Inner Pocket NR and Pine Creek (Tobys Rd)) where no larvae were found. Therefore, *P. i. smithersi* was found at 63 of the 130 sites containing *C. multisepalea* (48%). The species had not previously been recorded at 59 of these sites. A further nine new sites were collated from bush regenerators and others. Locating each larva required on average 14 minutes of searching *C. multisepalea* vines. However, the distribution of larvae was typically clumped and after the first larva was found, subsequent

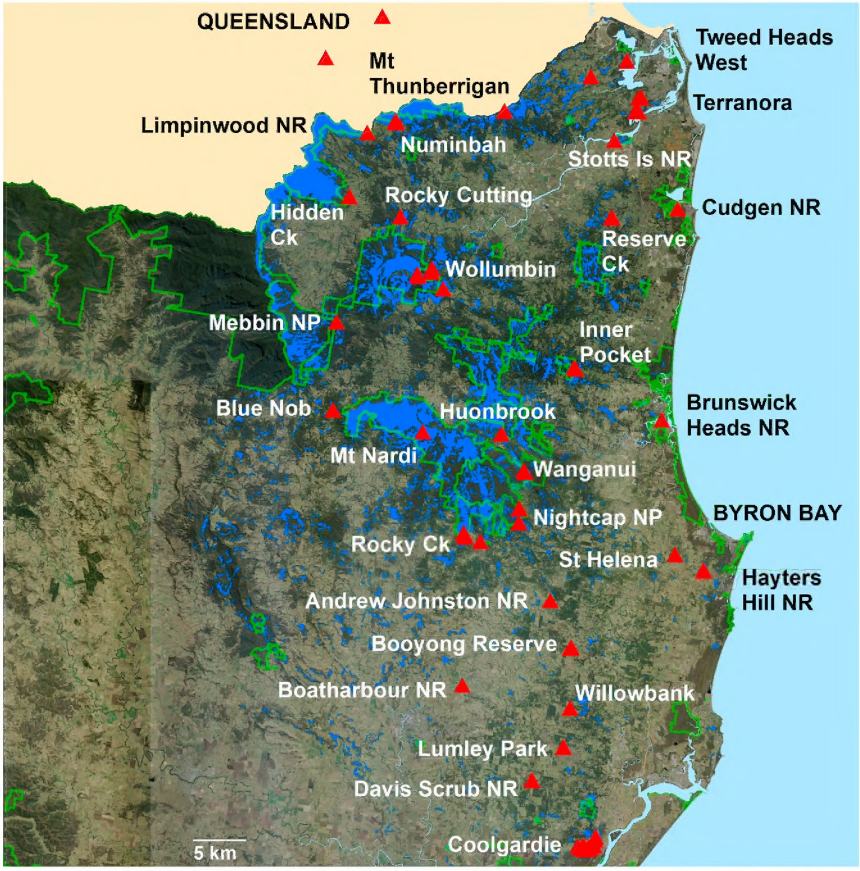

Fig. 5. The 29 localities known to be occupied by *Phyllodes imperialis smithersi* during this study in the Northern Rivers region (red triangles are records from the NSW BioNet) and the estimated extent of potential habitat (blue).

larvae were often found quickly. A better estimate of effort is that it required on average 64 minutes of searching vines to find the first larva at a site.

Larvae were found at an average height of 61 cm (n=317) and on *C. multisepalea* vines that were of median height 80 cm (n=269). Larvae preferred intermediate-age leaves (current season leaves that were not new). These comprised 74% of observations, while old leaves (hardened) comprised 19% and new leaves 7%. Since most larvae found were early instars (Table 1), these results reflect the feeding behaviour of early instars. There were 29 locations known to be occupied by *P. i. smithersi* during this study in the Northern Rivers (Fig. 5) and 10 in Bellinger-Orara (Fig. 6). Surveys were also undertaken by volunteers on Bellingen Island. They recorded *P. i. smithersi* larvae in November 2016 and

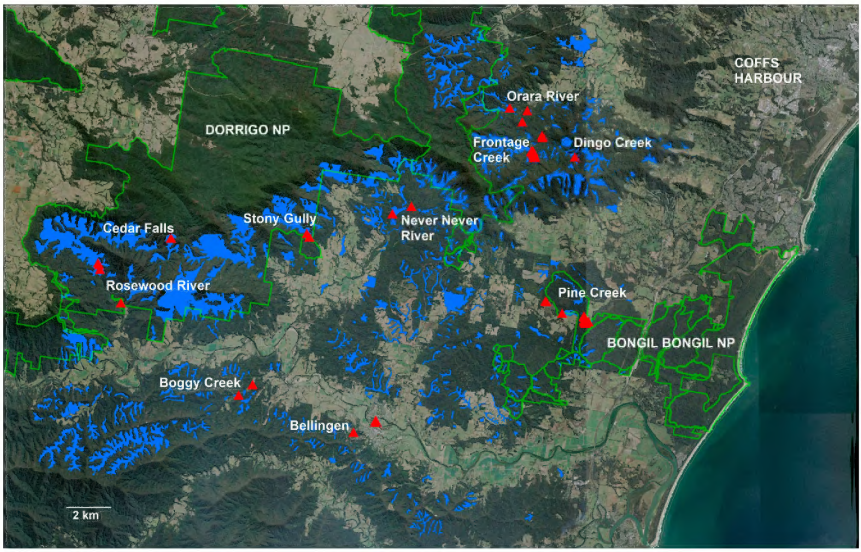

Fig. 6. The 10 localities known to be occupied by *Phyllodes imperialis smithersi* during this study in the Bellinger-Orara region (red triangles are records from the NSW BioNet) and the estimated extent of potential habitat (blue).

between late October 2017 and February 2018 recorded at least 53 larvae and 25 unhatched eggs. In repeated surveys in 2018, it was estimated that there was a 90% decrease in larvae numbers from early to late instars.

The broad assessment of the extent of potential *P. i. smithersi* habitat resulted in an estimate of 34,055 ha in the Northern Rivers (Fig. 5) and 5,230 ha in the Bellinger-Orara region (Fig. 6). The area of breeding habitat would be a small percentage of these figures due to the patchy distribution of *C. multisepalea*. The locations known to be occupied by *P. i. smithersi* during this study and potential habitat are relatively well reserved with almost half in National Parks and Nature Reserves (Table 2).

Discussion

At the commencement of this study, it was incongruous that the distribution of *P. i. smithersi* appeared to be highly restricted, while its larval food plant, *C. multisepalea*, was widely distributed. This study has revealed that the two distributions correspond quite closely.

A disjunct occurrence pattern, with the Northern Rivers population separated by 160 km from Bellinger-Orara, is not uncommon for a wet forest species and follows the distribution of coastal rainforest plant communities. The pattern of rainforest occurrence is a response to past volcanism centred on Wollumbin (Northern Rivers) and Ebor (Bellinger-Orara), that has produced a mountainous

Table 1. The number of each *Phyllodes imperialis smithersi* instar found, showing the predominance of early instars (80% third instar or earlier). First instars can be confused with *Eudocima fullonia*. However, since *E. fullonia* was rare in this study, we have assumed 'probable' *P. i. smithersi* first instars when they co-occurred with later *P. i. smithersi* instars. This has resulted in an under-estimate of the number of first instars, although the low number could also be partly explained by the inconspicuousness of this stage.

	No. of larvae	**% of total**
First instar	53	17
Second instar	129	40
Third instar	73	23
Fourth instar	35	11
Fifth instar	29	9
TOTAL	**319**	
Eudocima fullonia	8	

Table 2. The tenure of the 39 *Phyllodes imperialis smithersi* locations known to be occupied during this study, as well as the tenure of the mapped potential habitat. *NPWS: New South Wales National Parks and Wildlife Service.

Tenure	**Occupied Locations**			**Potential Habitat (ha)**		
	Northern Rivers	**Bellinger-Orara**	**Total**	**Northern Rivers**	**Bellinger-Orara**	**Total**
NPWS* estate	14 (48%)	4 (40%)	18 (46%)	16,940 (50%)	2,455 (47%)	19,395 (49%)
Council reserve	4 (14%)	1 (10%)	5 (13%)	64 (0.2%)	10 (0.2%)	74 (0.2%)
State Forest estate		5 (50%)	5 (13%)	126 (0.4%)	1,683 (32%)	1,809 (5%)
Private	11 (38%)		11 (28%)	16,925 (50%)	1,082 (21%)	18,007 (46%)
TOTAL	**29**	**10**	**39**	**34,055**	**5,230**	**39,285**

and fertile landscape in these two regions, separated by the broad dry, less fertile expanse of the Richmond River and Clarence River valleys.

The rainforest habitat of *P. i. smithersi* is dominated by the White Booyong *Argyrodendron trifoliolatum* F. Muell. lowland subtropical rainforest alliance (Floyd 1990), with three suballiances predominating: (i) White Booyong, (ii) Pepperberry-Giant Stinger-Fig-Hoop Pine, and (iii) Black Bean-Rosewood. At

higher elevations, while the habitat is still related to these three suballiances, it is also characterised by the presence of 'cool' subtropical species such as Black Booyong *Argyrodendron actinophyllum* F.M. Bailey. We consider that under normal environmental conditions these rainforest communities should provide enough fruit resources for the highly mobile adult moths.

Carronia multisepalea was found to be a common species in the rainforests of the Northern Rivers and was often locally abundant. *Phyllodes imperialis smithersi* larvae were found along drainage lines (e.g. Booyong Reserve), on ridges (e.g. Limpinwood Nature Reserve (NR)), steep slopes (e.g. Mt Thunberrigan), flat land (e.g. Davis Scrub NR) and from 5 m above sea level at Coolgardie to the highest known occurrence of 790 m at Mt Nardi. There are also relatively high elevation records along the McPherson Range in Limpinwood NR (510 m), Numinbah NR (400 m) and Mt Thunberrigan (350 m), plus a Queensland record less than 6 km north of the border at Binna Burra at 780 m (Lachlan 2014). Although patchily distributed, it appears likely that *P. i. smithersi* is a relatively common species in rainforest at all elevations along the McPherson Range.

Carronia multisepalea is also known from 590 m in Wollumbin NP where it has not been surveyed for *P. i. smithersi*. There is a high likelihood that *P. i. smithersi* occurs there, given its presence at lower elevations within the reserve. *Phyllodes imperialis smithersi* was recorded in major tracts of forest of the Wollumbin caldera, as well as 20 small remnants. Furthermore, of the 222 specific locations of records of *P. i. smithersi* in NSW (NSW BioNet), 89 are from monitoring at Coolgardie, conducted for the Pacific Highway Upgrade (Lloyd *et al*. 2019). The relatively large number of locations resulting from an increased survey intensity at Coolgardie supports our opinion that *P. i. smithersi*, while patchily distributed, is a widespread and relatively common species in the Northern Rivers.

Carronia multisepalea and *P. i. smithersi* are less common in the Bellinger-Orara region, although there are local concentrations, such as the lower Rosewood River in Dorrigo NP, Bellingen Island, Pine Creek and in the upper Orara River catchment. *Phyllodes imperialis smithersi* was found in most areas containing significant numbers of *C. multisepalea*, although there appeared to be a greater focus on riparian habitat than in the Northern Rivers. *Carronia multisepalea* appears to be absent from the high elevation rainforests in the region, although both species were recorded at an elevation of 470 m in Dorrigo NP.

Searching *C. multisepalea* vines for larvae was a labour-intensive technique, requiring an average search time of 64 minutes to locate a larva at a site. We have demonstrated, however, that it can be implemented successfully to survey *P. i. smithersi*. Larvae have been found from late October to early April (171 days), which aligns with the species having two generations per year and a lifespan of about 80 days: egg 8 days, larva 18 days, pupa 25 days and adult 30 days (based on 5 individuals reared at 25° C, Sands unpublished data, Sands 1999). Eggs (Fig. 7) were located at 16 sites. They were generally laid in small numbers (commonly one or two eggs on a leaf underside), but occasionally larger

Fig. 7. A typical egg of *Phyllodes imperialis smithersi* (approximately 2 mm in diameter) on the underside of a *Carronia multisepalea* leaf (Photo: P.G. Richards).

Fig. 8. Defoliation of a *Carronia multisepalea* plant: (a) Multiple second instar *Phyllodes imperialis smithersi* feeding, until (b) there are no leaves left on the plant (Photos: S.R. Ruming).

numbers (up to 35). Where large numbers of larvae hatch onto a plant, the result can be complete defoliation (Fig. 8).

An advantage of the focus on larvae is that all locations found are breeding sites. The sites were characterised structurally by rainforest with an average crown cover of 62%. This level of crown cover was often obtained in old growth rainforest, which Sands (2012a) found to be preferred habitat. Within these old growth forests, however, *C. multisepalea* favoured edges or canopy gaps, either naturally created (e.g. by tree fall) or anthropogenically created (e.g. by roads). Canopy gaps and edges promote the recruitment of a suite of other colonising species, including Lawyer Vine *Calamus muelleri* H. Wendl. and in some places weed species such as Lantana *Lantana camara* L. that may out-compete *C. multisepalea*. In these circumstances, management actions may be required to ensure the persistence of *C. multisepalea*.

Suitable levels of canopy cover can also be achieved in regrowth forests and some locations were highly disturbed (e.g. Orara River, St Helena and Pine Creek). Weeds are a major problem in regrowth rainforest (Fig. 9) and rehabilitation may also be required at these sites. Seven of the sites surveyed had a canopy cover of 30% or less and despite the presence of abundant *C. multisepalea*, currently appear to be unsuitable breeding habitat for *P. i. smithersi*. Five of these sites were undergoing assisted restoration and could be expected to provide suitable habitat once adequate canopy cover is reinstated.

Larvae of *P. i. smithersi* were observed on average 61 cm above the ground. Of course, the search effort was at ground level; leaves in the canopy were not surveyed. However, there are reasons to expect that the core breeding zone is less than two metres in height: (i) during the survey, leaves above two metres were examined where possible, but only on two occasions were caterpillars observed, (ii) above the mean height of 61 cm, the number of larvae found declined progressively, despite vines being thoroughly searched to about two metres, and (iii) it is likely to be difficult for larvae to find sufficient cover in the canopy to avoid desiccation and predators, and fresh leaves would be exposed and harden quickly. Four structural forms of *C. multisepalea* give rise to leaf growth within about two metres of the ground. These are: (i) seedlings, (ii) short vertical stems arising from subterranean rhizomes (Fig. 10), (iii) a prolific ground cover or tangled low vine found in canopy gaps or forest edges, and (iv) new growth (often sparse) at the base of mature vines.

Early instar larvae were recorded on the underside of *C. multisepalea* leaves (Fig. 10) and later instar larvae were often observed lying along the stems of the vine (Fig. 11) or along the mid-rib of a leaf upon which it was feeding. There was a very strong preference for leaves produced in the current growing season (81% of observations of larvae). The almost ubiquitous presence of browsed leaves (95% of sites), although not necessarily due to browsing by *P. i. smithersi*, is further indication that the moth and vine co-occur widely.

Fig. 9. *Carronia multisepalea*, browsed by *Phyllodes imperialis smithersi*, above a carpet of the weed Trad *Tradescantia fluminensis* Vell (Photo: M. Andren).

Fig. 10. Early instar *Phyllodes imperialis smithersi* larvae on a short vertical *Carronia multisepalea* stem (60 cm) arising from a subterranean rhizome (Photo: P.G. Richards).

Since European settlement, lowland rainforest has undergone a large reduction in area due to clearing (Floyd 1990, NSW Scientific Committee 1999, 2006). Floyd (1990) estimated that the original 75,000 ha 'Big Scrub' lowland rainforest of the Lismore basalts has been reduced to only 300 ha (0.4%) and much of the lowland rainforest has been lost from the Tweed, Bellinger and Orara valleys. Most remaining stands occur as small remnants of variable quality which are often isolated within highly modified agricultural landscapes (Threatened Species Scientific Committee 2011). Lowland rainforest is listed under State and Commonwealth legislation as an Endangered or Critically Endangered Ecological Community (NSW Scientific Committee 1999, 2006, Threatened Species Scientific Committee 2011).

Surveys were carried out in 14 of the small and isolated Big Scrub remnants. *Carronia multisepalea* is ubiquitous in these remnants (recorded in all remnants, although found by others in Victoria Park NR and in Rotary Park in Lismore, only one small plant was located). The most isolated remnant occupied by *P. i. smithersi* was Boatharbour NR. It is approximately 15 km to the nearest known occupied habitat in Booyong Reserve, which, like Boatharbour, is on the Wilson River. *Phyllodes imperialis smithersi* is a large moth and likely capable of powerful flight and it may be that all the Big Scrub remnants and potentially all the Northern Rivers (as well as adjacent rainforest in Queensland), is a single connected metapopulation. This widespread metapopulation potentially enables the recolonisation of a small remnant in the region if there was a local extinction, as well as colonisation of newly rehabilitated rainforest containing *C. multisepalea*. Crossing an open agricultural matrix between small forest remnants, however, is likely to expose the moths to increased predation from microchiropteran bats.

Prior to this study, *P. i. smithersi* was known from only two NPWS reserves in NSW (Davis Scrub NR and Dorrigo NP) and a council reserve (Bellingen Island). Of the 39 localities now known for the species, 18 (46%) are protected in 15 NPWS reserves (Table 2). A further 10 localities are on public land (i.e. a total of 72% on public land). The potential habitat of *P. i. smithersi* is also well protected with almost half within NPWS reserves. In the Northern Rivers, much of the rainforest habitat is steep, relatively inaccessible, generally in good condition and protected within conservation reserves. Only 13% of the potential habitat is in the Bellinger-Orara region, where *P. i. smithersi* is known from just 10 locations. There is likely to be a relatively large population in Dorrigo NP (where it is known from three locations) and there is an abundant localised population along Pine Creek in Bongil Bongil NP. Bellingen Island is a council reserve protected by an environmental zoning (Bellingen Shire Council 2010), but there is not a large amount of habitat on the island, and it is subject to flooding.

Six southern locations occur on State Forest (Scotchman, Tuckers Nob, Pine Creek and Orara West). Orara West State Forest contains an important population on Frontage Creek, Dingo Creek and the Orara River. While these sites benefit

Fig. 11. A fifth instar *Phyllodes imperialis smithersi* larva on a stem of *Carronia multisepalea* below a dead leaf, exhibiting a typical resting position along the stem and the effectiveness of its camouflage (Photo: P.G. Richards).

from the protection of riparian rainforest from logging under current State regulations, some of them are relatively heavily disturbed and have minor to major weed infestations. Management intervention may be required to secure the persistence of *P. i. smithersi* at some of these locations. Despite this, in these State Forests and Bongil Bongil NP, many of the now-protected rainforests are beginning to re-establish canopy cover and provide suitable breeding habitat for *P. i. smithersi*. Assuming protections remain in place, this habitat could potentially increase in quality and quantity.

Monitoring on Bellingen Island, although not comprehensive, indicated a 90% fall in numbers between early and late instars. Lepidopteran eggs and neonate larvae experience high predation rates and parasitisation of eggs occurs widely (e.g. by *Telenomus* sp. (Sands 1999)). Larvae of *P. i. smithersi* deploy a defensive strategy based on camouflage (Fig. 11) and, in the case of later instars, a dramatic warning display (Fig. 2). This suggests that *P. i. smithersi* does not utilise the alkaloids present in *C. multisepalea* for defence, unlike another large moth that feeds on the same plant, *E. fullonia*. Larvae of this species are coloured red and are much more active than *P. i. smithersi*, signifying to potential predators that it is unlikely to be palatable.

Clearing and weed invasion were important historical threats to *P. i. smithersi* and weed invasion remains a severe problem at many sites (Fig. 9). Unprecedented fires in 2019 burnt some of the rainforests in northeastern NSW (Nolan *et al*. 2019), including on Mt Nardi in Nightcap NP, which was the first time that such an event had been recorded. Fire is becoming an increasing threat to rainforest species and even a cool fire will threaten *P. i. smithersi*, with its breeding zone within two metres of the ground. During the drought conditions experienced from 2016 to 2019, at some time, most rainforest remnants in the region could potentially have sustained at least a leaf litter fire. Reduced productivity of *C. multisepalea* and reduced rainforest fruit production due to drought could also impact the species. Conversely, much of the rainforest habitat of *P. i. smithersi* is riparian and subject to flooding, which could become a serious threat if the frequency of flooding were to increase.

Phyllodes imperialis smithersi currently appears to be a secure species in the Northern Rivers, while in the Bellinger-Orara region, weed control and rainforest rehabilitation would help ensure its persistence. Along with many other species, however, it is becoming increasingly threatened by the intense droughts and fires that are consistent with the predicted consequences of anthropogenic climate change.

Acknowledgements

Shane Ruming has contributed many hours of searching for caterpillars in the Bellinger and Pine Creek catchments; he is also thanked for the use of his excellent photos. Trevor and Carol Deane have been tireless in researching and promoting the conservation of the species and Mark Graham kindly allowed us to use his rare photograph of the adult moth feeding. Comments from reviewers Ethan Beaver and Robert Lachlan improved the manuscript. We are grateful for the assistance of many others who helped with surveys, allowed access to their properties and supplied information, including: Caroline Blackmore, David Britton, Tony Bush, Lori Cameron, Maria Catanzaro, David Charley, Hamish Cobbett, Michael Corke, Suryo Cunningham, Phil Gilmour, Gabe Hart, Noel Hart, Sian Hromek, Wren McLean, Jaime Plaza, Nicholas Plaza, Mark Robinson, Iain Stych and Kath Vail. The project was funded by the *Saving our Species* program of the NSW government.

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KIMBERPSALTRIINI, A NEW TRIBE FOR A NEW AUSTRALIAN CICADA ALLIED TO *TALCOPSALTRIA* MOULDS (HEMIPTERA: CICADOIDEA: CICADIDAE)

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Abstract

A new tribe, Kimberpsaltriini, subfamily Cicadinae, is described to accommodate *Kimberpsaltria taenia* **gen. n.**, **sp. n.**, a species that is known only from the central Kimberley, Western Australia. Relationships of the new tribe are discussed, a key to the tribes of Australian cicadas in the subfamily Cicadinae is provided, and the song of the new species is analysed.

Keywords. *Talcopsaltria*, key to Cicadinae, cicada song, Kimberleys, Western Australia

Introduction

In a molecular phylogeny of world cicadas in preparation (Owen *et al*. pers. comm.), an undescribed Australian cicada was found to be sister to the Australian species *Talcopsaltria olivei* Moulds, 2008, tribe Talcopsaltriini. Following morphological examination this undescribed species was found to represent both a new genus and a new tribe. The species, genus and tribe are described here together with an analysis of the species' song. The last published key to tribes of Australian cicadas in the subfamily Cicadinae (Moulds 2008) is updated to include the Talcopsaltriini and three tribes described in Marshall *et al*. (2018).

Terminology for morphological features follows that of Moulds (2005, 2012). The following abbreviations are used: LWP, collection of L.W. Popple, Cairns; MSM, collection of M.S. Moulds, Kuranda; WAM, Western Australian Museum, Perth; UCS, University of Connecticut, Storrs, USA.

Male calling songs were digitally recorded in the field with a 96 kHz sampling frequency using a Zoom H4n audio recorder connected to a Sennheiser (Old Lyme, CT, USA) ME66 super-cardioid short shotgun microphone, which has a frequency response that is approximately flat from 40 Hz–20 kHz (+/- 2.5 dB). One additional recording at Mitchell Falls Campground was recorded using a Tascam DR-07 digital recorder with an Audio-Technica ATR-55 cardioid condenser shotgun microphone (frequency response 70 Hz–18 kHz). Air temperatures were recorded but cicadas are known to behaviourally thermoregulate by basking, so such temperatures do not necessarily correspond to body temperature (Heath 1967; Sanborn 2002). Oscillograms, spectrograms (sonograms), and power spectra were generated using Raven Pro v1.5.0 (Cornell Bioacoustics Laboratory, Ithaca, NY, USA). Summary characteristics of the songs were determined by

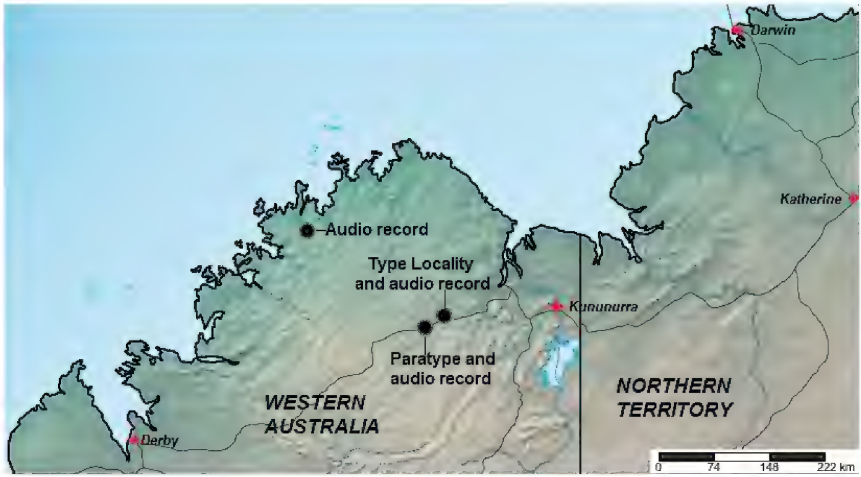


Fig. 1. Distribution of *Kimberpsaltria taenia* **gen. n., sp. n.** showing the three known localities in the Kimberley region of north-eastern Western Australia.

examination of the recordings in Raven Pro. Audio spectra were generated with a 512-sample Hann window, 3 dB filter bandwidth of 270 Hz, a hop size of 256 samples, and a DFT size of 512 points.

Kimberpsaltriini tribe n. Moulds, Marshall and Popple

ZooBank registration: urn:lsid:zoobank.org:act:DD6042C3-D8FF-47F9-84DE-7944F239DEF2

Type genus. *Kimberpsaltria* **gen. n.** (type species *Kimberpsaltria taenia* **sp. n.**).

Included genera. *Kimberpsaltria* **gen. n.**

Diagnosis. Head with distance between supra-antennal plate and eye about equal to length of supra-antennal plate. Postclypeus shape in transverse cross-section rounded, in lateral profile rounded between 'top' and 'sides'; postclypeal ridges lacking transverse grooves towards distal ends. Pronotal collar with lateral margin moderately ampliate; its width at dorsal midline less than diameter of eyes; with no mid-lateral tooth. Epimeral lobes not quite reaching opercula. Forewing pterostigma present; vein RA_1 aligned closely with subcosta (Sc) for its length; vein CuA_1 divided by crossvein so that distal portion is longest. Hindwing with anal lobe broad and vein 3A curved, long, separated from wing margin; width of 1st cubital cell at distal end longer than 2nd cubital cell. Foreleg femoral primary spine prostrate. Hindcoxae lacking a large inner protuberance. Meracantha gradually tapering to a point, triangular or nearly so. Male abdominal tergites with sides convex in cross-section; tergites 2 and 3 similar in size to 4–7; epipleurites reflexed to ventral surface, without an inward V-shaped kink; sternites IV–VI in cross-section convex. Timbals extended below wing bases. Timbal covers flat, reduced dorsally and reaching only about halfway to metathorax, lower margin extending anteriorly from or very near auditory capsule.

Fig. 2. *Kimberpsaltria taenia* **gen. n.**, **sp. n.**, male. Live adult of morph with partly yellowish dorsal midline. Specimen same locality as holotype.

Male genitalia (Figs 7–10) with pygofer dorsal beak present as a part of chitinized pygofer; upper lobe absent, basal lobes undivided, moderately developed. Uncus with median lobe large, dominant, bifurcate with lateral branch. Aedeagus restrained by apical ventral protrusion on either side of the uncus. Basal plate with ventral rib completely fused; theca with shaft recurved basally through 180° or more; without appendages. Male and female reproductive systems unknown.

Distinguishing features. Kimberpsaltriini **tribe n.** is distinguished from all other tribes in having, in combination, forewing basal cell tending rounded so

that the two sections of the arculus are of similar length, the timbal covers not covering the timbal and reduced dorsally, a deeply divided uncus, and a thecal shaft that turns through 180° at its base.

Phylogenetic relationships

In the molecular phylogeny of Owen *et al.* (in prep.) *Kimberpsaltria* was found to be sister to *Talcopsaltria* Moulds, 2008, sole genus of the tribe Talcopsaltriini. The males bear similarities in their short bodies and small eyes, their reduced timbal covers, the prostrate primary spine on their fore femora, and in the abundance of silver pubescence mixed with a fine waxy secretion that covers much of the body.

They differ in having the epimeral lobe reaching the operculum only in *Talcopsaltria*, the lateral margin of the pronotal collar smooth in *Kimberpsaltria* but minutely spined in *Talcopsaltria*, forewing vein CuA_1 divided by crossvein m-cu in *Kimberpsaltria* so that proximal section is shortest but longest in *Talcopsaltria*, the width of the 1st hindwing cubital cell at its distal end longer than 2nd cubital cell in *Kimberpsaltria* but shorter in *Talcopsaltria*, the hindwing anal lobe narrow in *Kimberpsaltria* but broad in *Talcopsaltria,* and the timbal covers of *Kimberpsaltria* reduced dorsally but extending anteriorly from their uppermost point in *Talcopsaltria*. In the male genitalia the uncus is deeply divided in *Kimberpsaltria* but not in *Talcopsaltria*, the distal shoulders are undeveloped in *Kimberpsaltria* so that the dorsal beak becomes large and prominent whereas in *Talcopsaltria* the distal shoulders are well developed and the dorsal beak very small, and the shape of the aedeagus is markedly different.

All the preceding characters are phylogenetically informative at tribal level (*sensu* Moulds 2005). The large number of these not shared with *Talcopsaltria* (type species of tribe Talcopsaltriini) means that *Kimberpsaltria* cannot be included in the Talcopsaltriini. Its attributes are also incompatible with other described tribes (compare tribal definitions in Moulds (2005) and Marshall *et al.* (2018)). Thus, we establish here the Kimberpsaltriini **tribe n.**

Key to tribes of Australian Cicadinae

The key to Australian Cicadinae (Australian species whose males have timbal covers) in Moulds (2008) is here revised to incorporate the new tribe described below and the three new Australian tribes added by Marshall *et al.* (2018). Some characters used for distinguishing Australian members of some tribes (Cosmopsaltriini, Platypleurini) may not be applicable to some non-Australian species belonging to these tribes. Characters used in the key were selected because they best separated taxa, not because they necessarily defined monophyletic groups. Male genitalia are not used here to avoid the necessity for doing dissections although they are important in tribal diagnoses.

1. Fore leg femoral primary spine lying flat, prostrate 2
– Fore leg femoral primary spine erect 3

2. Lateral margin of pronotal collar (paranotum) dilated horizontally; male timbal cover reaching, or almost reaching, metathorax ..... **Platypleurini** Schmidt, 1918
– Paranotum not dilated horizontally; male timbal cover only reaching about half way to metathorax ..... **Talcopsaltriini** Moulds, 2008

3 Head including eyes clearly wider than lateral angles of pronotal collar 4
– Head including eyes about as wide or narrower than lateral angles of pronotal collar 5

4. Male abdominal segments 2 and 3 occupying at least half the length of abdomen; female indistinguishable ..... **Psaltodini** Moulds, 2018
– Male abdominal segments 2 and 3 occupying much less than half the length of abdomen; female indistinguishable .. **Thophini** Distant, 1904

5. Hindwing apical cell 1 very short, very much shorter than apical cell 3 ..... **Jassopsaltriini** Moulds, 2005
– Hindwing apical cell 1 very long, about as long as apical cell 3 6

6. Forewing veins C and R+Sc widely separated ..... **Cyclochilini** Distant, 1904
– Forewing veins C and R+Sc abutted for their length 7

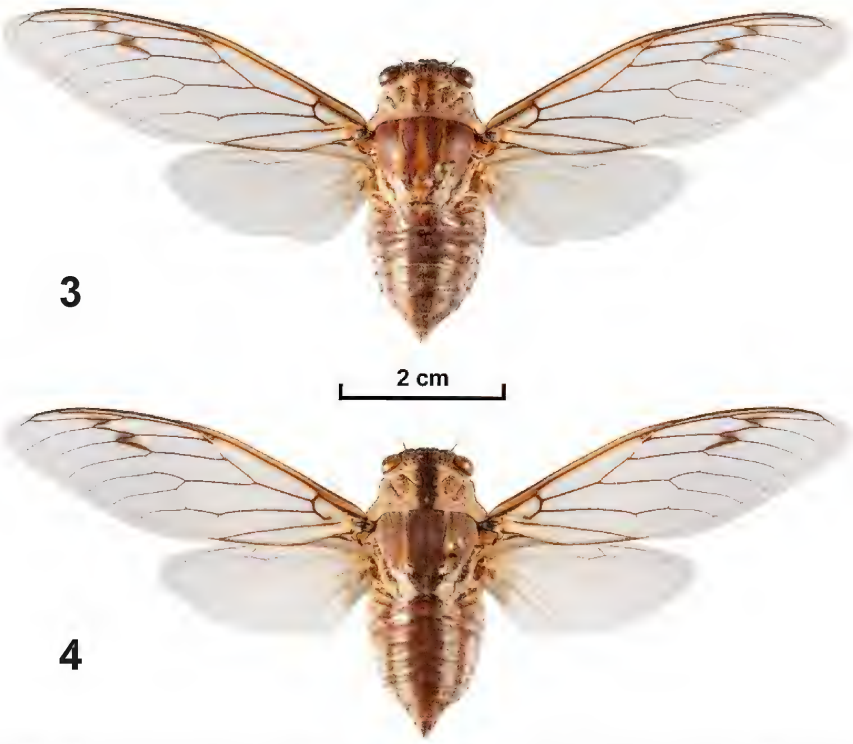
7. Forewing basal cell long and slender, the two sections of the arculus together far shorter than its remaining inner side (base of vein CuA) 8
– Forewing basal cell tending rounded, the two sections of the arculus together about as long as its remaining inner side (base of vein CuA) 9

8. Lateral margin of pronotal collar with a midlateral tooth; male timbal covers covering timbal cavity ..... **Cosmopsaltriini** Kato, 1932
– Lateral margin of pronotal collar without a midlateral tooth; male timbal covers much reduced and exposing much of timbal membrane ..... **Tamasini** Moulds, 2005

9. Pronotal collar very wide, occupying almost one third the length of pronotum ..... **Macrotristriini** Moulds, 2018
– Pronotal collar narrower, occupying no more than a quarter the length of pronotum 10

10. Lateral margin of pronotal collar with minute teeth; male timbal covers covering timbal cavity ..... **Arenopsaltriini** Moulds, 2018
– Lateral margin of pronotal collar smooth, without minute teeth; male timbal covers much reduced and exposing much of timbal membrane 11

11. Head wider than lateral margin (paranotum) of pronotal collar ..... **Burbungini** Moulds, 2005
– Head as wide as lateral margin (paranotum) of pronotal collar ..... **Kimberpsaltriini tribe n.**



Figs 3, 4. *Kimberpsaltria taenia* **gen. n., sp. n.**, male. (3) male holotype, dorsal, morph with partly yellowish dorsal midline; (4) male, dorsal, of morph with entirely dark reddish brown dorsal midline, same locality as holotype.

Kimberpsaltria Moulds, Marshall and Popple gen. n.

ZooBank registration: urn:lsid:zoobank.org:act:11050239-BEF6-4BB7-9939-652EE1A301C1

Type species. ***Kimberpsaltria taenia*** **sp. n.**, here designated.

Included species. Monotypic, ***Kimberpsaltria taenia*** **sp. n.**

Etymology. Derived from the name of the region where the genus is found, *Kimberley*, and the Greek *psaltria*, a female harpist and a traditional ending for many cicada generic names; feminine.

Distribution (Fig. 1). Central Kimberley, Western Australia.

Diagnosis. Male body tending rounded in cross-section. *Head* including eyes narrower than mesonotum; postclypeus with ventral midline keeled, not grooved. *Thorax* with cruciform elevation with its dome wider than long; epimeral lobe not reaching operculum. *Forewings* hyaline; infuscation overlaying veins at bases of apical cells 2, 3 and 4; with 8 apical cells; subapical cells absent; ulnar cell 3 angled to radial cell; costal vein (C) no higher than R+Sc; costa parallel-sided

to node; vein CuA only weakly bowed so that cubital cell no larger than medial cell; veins M and CuA widely separated at basal cell making basal cell broad and tending to be rounded; wing outer margin developed for its total length, never reduced to be contiguous with ambient vein. *Hindwings* with 6 apical cells; no infuscation on ambient vein. *Male opercula* completely encapsulating meracanthus, reaching distal margin of tympanal cavity, not meeting. *Male abdomen* shorter than head plus thorax; sternite VIII strongly tapered so that its distal end is only about half the length of base. *Timbal* with four long ribs with prominent intermediate short ribs; basal dome small.

Male genitalia (Figs 7–10) with pygofer dorsal beak well developed and about an equilateral triangle; basal lobes in lateral view gradually tapering to a rounded apex, slender in ventral view. Uncus divided, lateral branch of uncus with a flat, 'blinker'-shaped, dorsal projection apically each side. Aedeagus with basal plate strongly arched in lateral view, its basal portion tending parallel to thecal shaft with midline deeply furrowed; apical margin of basal plate nearly straight, without spreading arms; junction between theca and basal plate rigid, without a 'hinge'; theca parallel-sided, its apex entirely chitinized with two small triangular lobes ventrally, one behind the other; vesica opening apical on theca, sloping backwards dorsally; vesica retractable; thecal subapical cerci absent; legula absent; conjunctival claws absent.

Female unknown.

Distinguishing features. The attributes that distinguish the tribe also distinguish the genus from all other genera.

Kimberpsaltria taenia sp. n. Moulds, Marshall and Popple

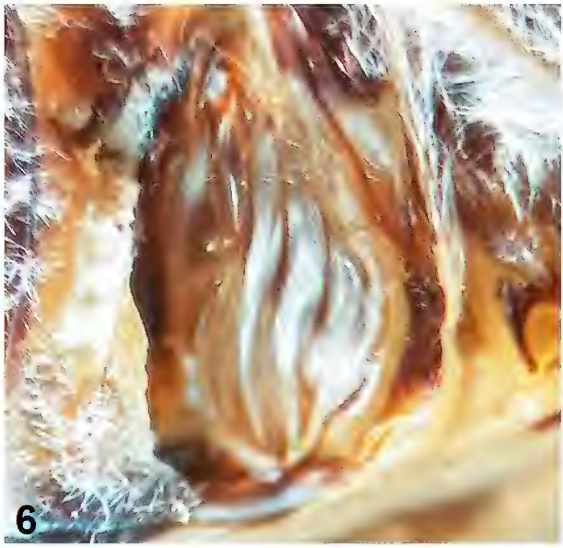
ZooBank registration: urn:lsid:zoobank.org:act:F8F77E6E-814F-4874-9003-8F788936821D

(Figs 1–12)

Types. *Holotype* ♂, AU.WA.DRK, Western Australia, Gibb R. Rd at Durack R./Bamboo Ck jct., 15°51.61'S 127°21.96'E, 240 m, 19.xi.2011, K. Hill, D. Marshall (in WAM, Registration No. WAM E109771). *Paratypes* as follows: WESTERN AUSTRALIA: 4 ♂♂ (1 genitalia prep. KIM 1, 1 molecular voucher 11.AU.WA.DRK.04), same data as holotype; 1 ♂ (genitalia prep. RS 1 and molecular voucher 11.AU.WA.DRX.10), Gibb River Rd, ~11 km WSW of Durack R. x-ing, 15°58.83'S 127°7.78'E, 340 m, 19.xi.2011, K. Hill, D. Marshall (MSM). 1 ♂, same data as holotype (LP). 1 ♂ (molecular voucher 11.AU.WA.DRK.06), same data as holotype (UCS). 2 ♂♂, same data as holotype (WAM, Registration Nos WAM E109772, WAM E109773).

Additional localities based on audio recordings. Mitchell Falls Campground, 14.8212°S 125.7169°E, 8.x.2009, L. Popple.

Distribution and habitat (Fig. 1). Western Australia where the species is known from only three localities in the Kimberley region; two are along the Gibb River Road, one at the Durack R./Bamboo Ck. confluence and the other 11 km WSW of the Durack River crossing. The third location is at Mitchell Falls Campground on the Mitchell Plateau. Those from the site WSW of the Durack R. crossing were found well away from the road (K. Hill *pers. comm.*). Adults inhabit eucalypts



Figs 5, 6. *Kimberpsaltria taenia* **gen. n., sp. n.**, male, same locality as holotype. (5) ventral view, mid- and hindlegs at left removed to be used as sequencing samples; (6) timbal, exposed after removal of timbal cover.

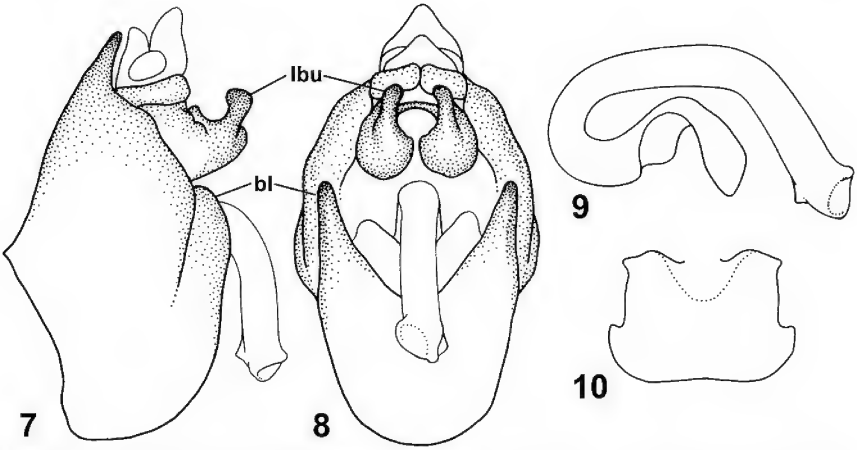
but are usually not very high and are not particularly wary. There are records for mid October and mid November.

Etymology. Derived from the Latin *taenia* meaning band or stripe, and referring to the bold dorsal body stripe and the striped abdomen so distinct in live specimens.

Adult description

Male (Figs 2–10). Head, body and legs of live specimens extensively covered in a 'dusting' of fine silver white pubescence partly mixed with a fine, white, waxy exudation. In two colour morphs, one with a bold, very dark reddish-brown stripe down the dorsal length, the other with the interior of this stripe on the thorax yellowish.

Head black with a brown spot on posterior midline and another over each supra-antennal plate; a brown patch not always distinct either side of ocelli reaching to posterior margin of head and sometimes to back of eyes; eyes of live specimens light brown. Postclypeus light brown, black dorsally, and with black transverse ridges ventrally. Anteclypeus light brown to black, variable between individuals. Rostrum black with base light brown laterally to variable degrees; reaching mid length of hind coxae. *Pronotum* brown, one colour morph with a distinct yellowish midline bordered either side by a very dark reddish brown stripe that turns inwards on pronotal collar, as in the holotype (Figs 2–3), the other



Figs 7–10. *Kimberpsaltria taenia* **gen. n., sp. n.**, male genitalia, paratype (genitalia prep KIM 1). (7) pygofer in lateral view; (8) pygofer in ventral view; (9) aedeagus in lateral view; (10) basal plate in dorsal view. *bl*, basal lobe; *lbu,* lateral branch of uncus.

morph with a broad, very dark reddish-brown midline (Fig. 4); hints of black in paramedian and lateral fissures, and black edging to paranota and lower lateral angles of pronotal collar. *Mesonotum* with one colour morph having a yellowish stripe along midline that gradually widens towards its posterior and bordered either side by very dark reddish brown, as in the holotype (Figs 2–3), the other morph with a very broad dark reddish brown midline (Fig. 4); a submedian pair of yellowish stripes, narrower than median stripe, extending from anterior margin to anterior arms of cruciform elevation; cruciform elevation yellowish brown with a black band across each anterior arm at about mid length, and a black patch between anterior and posterior arms that extends across upper part of posterior arms. *Wings* hyaline. Forewing with infuscation on crossveins r and r-m and sometimes at base of apical cell 4; costa light brown, venation otherwise black or nearly so. Hindwing venation brown and mostly very pale, except base of vein 3A black; a narrow white plaga on 2A and a wider plaga on 3A, both reaching almost full length. *Legs* mostly mid to dark brown, the hindlegs tending a little paler than others and sometimes with tibiae yellowish; mid and hind coxae yellowish with a black fascia on anterior face; meracantha dark brown basally becoming yellow at apex. Opercula broad and rounded except for partly straight distal margin, not quite meeting, confined to margins of tympanal cavity, black fading to dull yellow distally to varying extent but mostly so at distal outer quarter. *Abdomen* with tergites brown, the dorsal midline with a broad dark brown fascia tapering at its posterior end, and a narrower lateral fascia of similar colour; in life abdomen laterally densely covered in silver pubescence except for a brown pubescent lateral stripe (Fig. 2). Sternite II black, others light brown. *Timbal covers* brown becoming black on dorsal and ventral thirds; reaching about halfway across timbal cavity. *Timbals* with 4 long ribs spanning timbal membrane, none of which are joined dorsally (Fig. 6).

Genitalia (Figs 7–10), see generic description above.

Measurements. Range and mean (in mm) for 10 males (all known specimens). *Length of body*: 22.0–24.5 (23.5). *Length of forewing*: 29.1–32.5 (31.1). *Width of head* (including eyes): 7.5–8.3 (7.9). *Width of pronotum* (across lateral angles): 9.7–10.6 (10.1).

Female unknown.

Song

The description below is based on 110 seconds of unobstructed male calling song sampled from two males from the AU.WA.DRK site and 1–2 from the AU.WA.DRX site (see *Types* for locations). The recordings included additional partly informative sound sample that contained overlapping songs or background noise. The recordings were taken during the afternoon of 19 November 2012, about 14:30 at DRK and 16:15 for DRX, both under sunny, hot conditions (*ca.* 34°C). One clear recording of 50 s duration, taken at dusk and treated here as conspecific with the DRK and DRX recordings, was obtained from Mitchell Falls in 2009.

Males sing continuously for indefinite periods of time. The fine structure of the sound appears as sound pulses lasting approximately 0.5–1.0 ms followed by much quieter pulses with a much less predictable pattern (not shown). Without further study and timbal mutilation experiments (e.g., Fleming 1975), it is not possible to link these sound pulses to the presumed in-out click mechanisms of the paired timbals, and when we use the term 'pulse' below we refer only to the large-amplitude sound bursts.

The primary pulses are produced at steady or slightly accelerating rates in two kinds of syllable or echeme, one with strong pulses produced at a relatively slow rate (here called the 'slow-pulse echeme', with pulse rates of about 81–88/s at 34°C), and the other with pulses of approximately half the intensity produced at rate about 1.5 times faster ('fast-pulse echeme', 119–137/s at 34°C) (Fig. 11). In all recordings, the male continuously alternates between these two echemes, leaving a very short gap of about 0.01–0.03 s in most cases. The male may produce longer fast-pulse echemes or longer short-pulse echemes, but for most of our recorded sample the slow-pulse echemes are longer and the durations of the two echemes are within the same order of magnitude (approximately 0.08–0.6 s). In one exception, a male produced one fast-pulse echeme for about five seconds, and this might have been due to a close approach by the recordist. In the dusk recording from Mitchell Falls, the pulse rates are all slower, but the same ratio of 1.5/1 is found between the rates of the fast-pulse and slow-pulse echemes.

Notably, the dusk-singing male at Mitchell Falls produced a longer gap of 0.08 s three times. This gap in each case was preceded by an unusual slow-pulse echeme in which several of the last pulses were produced with the reduced amplitude of the fast-pulse echemes; the gap was then followed by a normal fast-pulse echeme as the alternation resumed. These song structures were not recorded at the AU.WA.DRK or AU.WA.DRX sites. These gaps could be a distinct feature of

the song of the Mitchell Falls population, or they might be a change to the song structure that occurs at dusk, a phenomenon observed in some other Australian cicadas (e.g. Ewart 2001; Popple 2017).

Frequency profiles taken across 8–50 s samples of the recordings show that sound is produced across a range of at least 4.5–20 kHz, but most of the energy is concentrated at lower frequencies (Fig. 12). The dominant pitch varies from 7.9–9.3 kHz across the sampled song segments, with most around 8.8–9.3 kHz; in the case of the 7.9 kHz sample a second peak of nearly equal intensity was found at 9 kHz. The -10 dB frequency envelope (the range in which the spectrum remains within 10 dB of the peak) ranges from approximately 7–10.5 kHz. Separate measurements of the fast- and slow-click echemes suggest only subtle differences in their frequency profiles, with the former having a flatter frequency profile and the latter a greater peak close to the overall song dominant pitch.

The pulse pattern and quality of the slow-pulse echeme is superficially similar to that of *Talcopsaltria olivei*, the sound of which is illustrated in Moulds (2008).

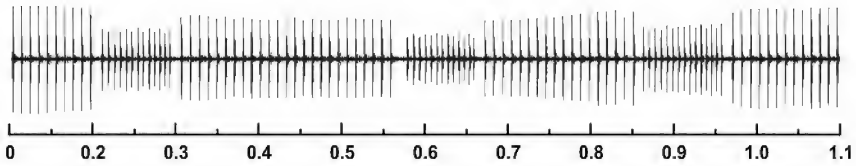


Fig. 11. Oscillogram of *Kimberpsaltria taenia* **gen. n.**, **sp. n.**, male calling song sample from Gibb R. Rd. 11 km WSW of the Durack R. crossing showing three fast-pulse echemes, two complete slow-pulse echemes, and two partial slow-pulse echemes. X-axis in seconds.

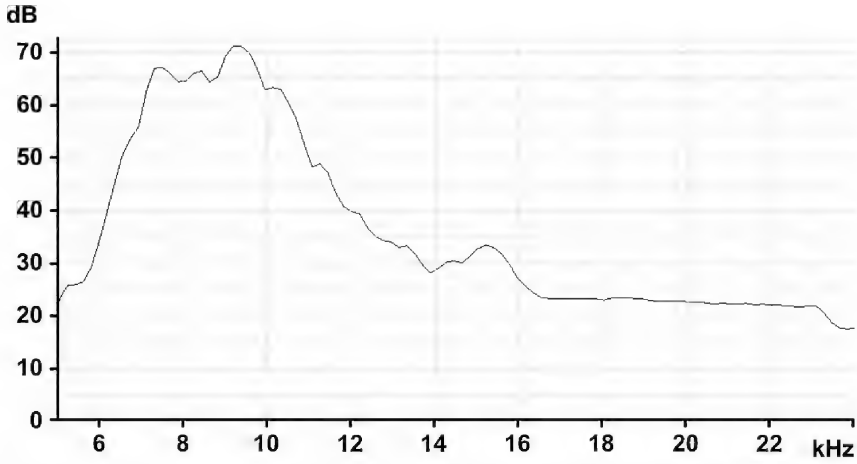


Fig. 12. Frequency spectrum of a 3.5 s sample of *Kimberpsaltria taenia* **gen. n.**, **sp. n.**, male calling song from Gibb R. Rd. 11 km WSW of the Durack R. crossing.

However, *Talcopsaltria* is lower in dominant frequency and is not known to produce a pulsed song of alternating echemes.

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ENICMUS THOMSON (COLEOPTERA: LATRIDIIDAE) IN AUSTRALIA, WITH DESCRIPTIONS OF THREE NEW SPECIES

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Abstract

The world distribution and biology of the genus *Enicmus* Thomson, 1859 and its occurrence in Australia are reviewed. All Australian species are described, their distributions recorded, and a key included to all described species and an unnamed species from Christmas Island. The following new species are described: *E. aberrans*, **sp. n.**, *E. notialis*, **sp. n.** and *E. norfolcensis* **sp. n.** The species *E. denticollis* (Lea, 1906) (*Lathridius*), **syn. n.** is considered to be a junior synonym of *Enicmus foveatus* Belon, 1884, described from New Zealand. Comments are also made concerning the terminology applied to the latridiid aedeagus.

Keywords: Taxonomy, Coleoptera, Latridiidae, morphology, distribution, spore feeders, Myxomycetes

Introduction

Enicmus Thomson, 1859, is a widespread genus with about 50 described species. Although the genus is relatively common in New Zealand, only one species has yet been described from Australia. The present work includes descriptions of two new species from both mainland Australian and Tasmania and one from the offshore Australian island of Norfolk Island in the Pacific Ocean. An unnamed species is recorded from the Australian territorial Christmas Island in the Indian Ocean. The described Australian species, *E. denticollis* (Lea, 1906) is found to be a synonym of the New Zealand species, *E. foveatus* Belon, 1884, and is recorded from Tasmania and the eastern mainland Australian states. A key is given to all four species now known from Australia and its territories.

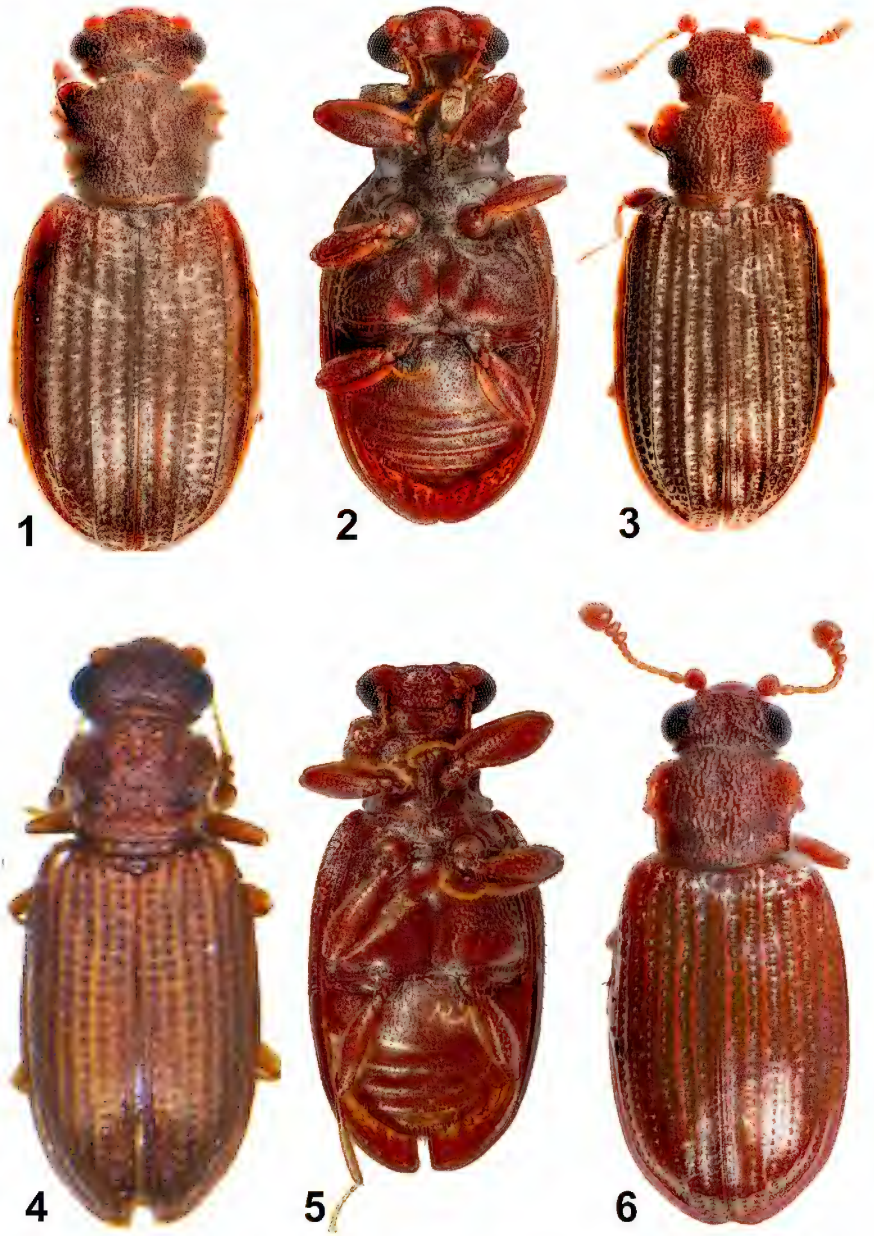
Materials and Methods

Except in the case of holotype designation, specimen data is not exactly as on labels, but is more or less uniform throughout the text. Latitude and longitude are given only when indicated on the label. Dates are in the following format: 15.iii.1989. Descriptions of forest type (e.g. rainforest) are usually omitted, although pyrethrum fogging of specific tree species is indicated.

Morphological terms, in general, follow those used in Lawrence *et al.* (2011) and Lawrence and Ślipiński (2013) plus the following references on the family: Belon (1884, 1897, 1909), Hinton (1945), Peez (1967), Andrews (2002), Majka *et al.* (2009), Hartley and McHugh (2010), Lord *et al.* (2010), Rücker (2018) and Hammond and Chambers (2020). Head length excludes the labrum and head width is that immediately behind eyes. Lengths of the mesoventrite and metaventrite exclude the posterior or anterior intercoxal processes, respectively. Some genitalic features require clarification. Although the aedeagus has often

been illustrated in taxonomic works, its component parts have rarely been labelled. Recent illustrations of typical *Corticaria* aedeagi by Rücker (2018, figs 42, 43) and Hammond and Chambers (2020, fig. 2) are the first clearly labelled figures this author has seen, but the terms used differ in the two works. In the Rücker figures the main posterior sclerite is labelled **Phallus** and the anteriorly projecting apically acute process is the **Phallobasis**. The membranous sac containing spines and sclerites is called **Praeputial Sac**, and the strut which is ventral to the phallobasis but curved dorsally to enclose the base of the phallus is called the **Fibula.** In the figure by Hammond and Chambers, the phallus and phallobasis of Rücker are labelled **Median Lobe** and **Median Strut**, respectively. The dorsal flap on the median lobe is called the **Flange**, and the term **Endophallus** is given to praeputial sac of Rücker. Finally, the fibula of Rücker is termed **Tegmen** by Hammond and Chambers. The male genitalia of coccinelloid beetles are sometimes difficult to understand, but one feature which is relatively easy to homologise in latridiids is the structure called the fibula or tegmen above. This structure represents abdominal segments IX and X combined (although the latter is entirely membranous) and is homologous to the **Pregenital Ring** (open posterior section) and **Spiculum Gastrale** (anterior strut) of other Coleoptera and not part of the aedeagus. The major portion of the aedeagus appears to be the **Penis** since it does have a dorsal flap (or flange of Hammond and Chambers) through which the **Endophallus (**the correct term for the spine bearing sac) is everted. The body of the true **Tegmen** is reduced but may be produced anteriorly as a **Tegminal Strut** (phallobasis or median strut of Rücker and Hammond and Chambers, respectively). Fig. 40 is a modified version of the Hammond and Chambers figure with the proposed new terminology. These terms seem to apply to at least some groups of Corticariinae but may not apply to all latridiids. The *Enicmus* aedeagus varies in its complexity and is often highly reduced. That of *Enicmus notialis* **sp. n.** is complex and includes all the structures described above, but in the other three Australian species it is highly reduced.

Descriptions of new species here are based on complete dissections of male and female paratypes, while redescriptions are based on one or more designated paratypes. For each species, total length range is given based on a superficial examination of all material examined, and this is followed by the range, mean and standard deviation for a smaller series. The following ratios are also based on a subset of the type series: 1) total length including head in mm; 2) length of body (pronotum plus elytra)/greatest width of combined elytra; 3) pronotal length at midline/greatest pronotal width; 4) elytral length at midline but including scutellar shield/greatest width of combined elytra; 5) elytral length/pronotal length; and 6) greatest depth, measured in lateral view from the highest point in the dorsal elytral curvature to the lowest point on the metaventrite/greatest width of combined elytra. Colour descriptions in the text below are based primarily on fully pigmented individuals. Since most specimens are collected at light, in pitfalls or in intercept traps, teneral individuals are not common.



Figs 1–6. *Enicmus* spp., habitus: (1) *E. aberrans* **sp. n.**, holotype, dorsal, 1.80 mm; (2) same, paratype, ventral. (3) *E. notialis* **sp. n.**, holotype, dorsal, 1.85 mm. (4) *E. norfolcensis* **sp. n.**, paratype, dorsal, 1.67 mm. (5) *E. foveatus* Belon, ventral, 1.5 mm; (6) same, dorsal.

Information on microstructure and most measurements of antennomeres, mouthparts, elytral punctation, and male genitalia were derived from specimens in glycerine using a Leitz Wetzlar compound microscope with 10× and 32× objectives, and images of these made with a Dino-Eye AM4023XC Eyepiece Camera attached to both the compound microscope and to a Leica MZ16 dissecting microscope (Figs 7–39), using DinoCapture 2.0 software. These images were basically snap shots and did not involve image stacking. Habitus images (Figs 1–3, 5, 6) were photographed at the Australian National Insect Collection in Canberra using a Visionary Digital Imaging System (Dun Inc.), a Canon camera with Visionary Digital lift and Canon MPE 65mm lens plus extender. Image stacking was accomplished with Zerene Stacker Pro. The image in Fig. 4 was produced by the staff of the New Zealand Arthropod Collection, Landcare Research, Auckland, using a Nikon DS-Ri1c digital camera with a Leica stereomicroscope; the stacking photography was done manually, and the stacking software was Helicon Focus.

The following abbreviations have been used for institutions which have provided specimens for study or which are repositories of types: **AMS**, Australian Museum, Sydney, NSW, Australia; **ANIC**, Australian National Insect Collection, CSIRO Australian National Research Collections, Canberra, ACT, Australia; **CAS**, California Academy of Sciences, San Francisco, California, USA: **CMN**, Canadian Museum of Nature, Ottawa, Ontario, Canada; **FMNH**, Field Museum of Natural History, Chicago, Illinois, USA; **MCZ**, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA; **MVM**, Museum of Victoria, Melbourne, Victoria, Australia; **NHML**, Natural History Museum, London, UK; **NMNH**, National Museum of Natural History, Washington, D.C, USA; **SAM**, South Australian Museum, Adelaide, SA, Australia; **NZAC**, New Zealand Arthropod Collection, Auckland, New Zealand; **QMB**, Queensland Museum, Brisbane, Queensland, Australia.

Key to the Australian species of *Enicmus* Thomson

1. Anterior pronotal angles not produced forward (Figs 4–6); prosternum in front of coxae without median carina; elytral punctures shallow and neither deep nor translucent (Figs 24, 25); elytral intervals not or weakly raised; metaventrite without pair of curved carinae extending posterolaterally from mesocoxal cavities 2

   Anterior pronotal angles produced forward and laterally (Figs 1–3); prosternum in front of coxae with median carina (Fig. 12); elytral punctures deep and translucent (window punctures, Figs 22, 23); metaventrite with pair of curved carinae extending posterolaterally from mesocoxal cavities (Figs 15, 16) OR elytral intervals 3, 5 and 7 distinctly raised to form distinct costae (Fig. 3) 3

2 (1). Sides of pronotum without lateral teeth (Fig. 4); mesocoxal cavities separated by more than 1.7 times diameter of a cavity (Fig. 19); antennomere 11 about 2.5 times as long as 10; first abdominal ventrite without pair of diverging lines behind intercoxal process; elytral interspaces dull; Norfolk Island ..... *Enicmus norfolkensis* **sp. n.**

Sides of pronotum usually with at least two teeth at anterior third (Fig. 6); mesocoxal cavities separated by less than 1.5 times diameter of a cavity (Fig. 17); antennomere 11 more than 3 times as long as 10 (Fig. 8); first abdominal ventrite with pair of diverging lines behind intercoxal process (Fig. 21); elytral interspaces shiny; widely distributed in Australia and also occurring in New Zealand ..... *Enicmus foveatus* Belon

3 (1). Temples more than half as long as eyes (Fig. 3); pronotal disc with pair of fine longitudinal carinae (Fig. 3), sometimes incomplete or apparently absent; median prosternal carina not extending beyond anterior edge of prosternum; mesoventrite with several fine, longitudinal carinae (Fig. 18); metaventrite without paired, curved carinae (Fig. 18); first abdominal ventrite without paired diverging lines behind intercoxal process; sides of pronotum without small teeth; widely distributed in TAS and also occurring in southern WA ..... *Enicmus notialis* **sp. n.**

Temples less than half as long as eyes (Fig. 1); pronotal disc without longitudinal carinae; median prosternal carina extending beyond anterior edge of prosternum (Fig. 12); metaventrite with paired, curved carinae (Fig. 16); first abdominal ventrite with paired diverging lines behind intercoxal process; sides of pronotum each with at least one small tooth at anterior third (Fig. 1) 4

4 (3). Antennae more than 1.7 times as long as head width; pronotal disc with broad, median longitudinal impression (Fig. 1); elytral window punctures circular but enclosed within subquadrate cells (Fig. 22); elytral intervals 3, 5 and 7 distinctly raised (costate) (Fig. 1); widely distributed in Australia ..... *Enicmus aberrans* **sp. n.**

Antennae slightly longer than head width; pronotum without longitudinal impression; elytral window punctures narrowly elongate and not enclosed within subquadrate cells; elytral intervals not or only weakly raised; Christmas Island ..... *Enicmus* sp.

Frequently used collector names and some other terms in the specimen lists have been shortened as follows: **AC**, A. Calder; **AN**, A. Newton; **Ck**, Creek; **DC**, D.J. Cook; **EE**, E. Edwards; **EN**, E. Nielsen; **FIT**, flight intercept trap; **FMHD,** Field Museum, Chicago, Sample No.; **FR**, Forest Reserve; **GM,** G.B. Monteith;

GT, G.I. Thompson; **HJ**, H. Janetzki; **IN**, I. Naumann; **JC**, J. Cardale; **JL**, J.F. Lawrence; **MC**, M. Cermak**; MH**, M. Horak; **MTp**, malaise trap; **MT**, M. Thayer; **NP**, National Park; **PF**, pitfalls; **pyr.,** pyrethrum**; R.**, River; **Rd,** Road**; SF**, State Forest; **SJP**, S. and J. Peck; **TW**, T. Weir; **WD**, W. Dressler

Family Latridiidae Erichson, 1842
Subfamily Latridiinae Erichson, 1842
Genus *Enicmus* Thomson, 1859: 233

Enicmus Thomson, 1859: 233. Type species: *Ips transversus* Olivier, 1790, by monotypy.

Diagnosis. This genus is placed in the subfamily Latridiinae based on the following characters: clypeus on lower plane than frons, frontoclypeal suture a deep transverse groove, frons coarsely and somewhat rugosely punctate, often with forked process; procoxal cavities separated by prosternal process; upper surfaces smooth or with hairs or bristles visible only under higher magnifications (30x to 40x); elytra often with longitudinal costae or carinae; lateral edges of pronotal disc not denticulate; sides of body subparallel or slightly widened behind middle. Within the subfamily, members of the genus are further distinguished by the keeled prosternal process elevated (in ventral view) so that it extends to the level of the coxae, lack of deep lateral pronotal indentations and almost universal lack of paired longitudinal pronotal carinae.

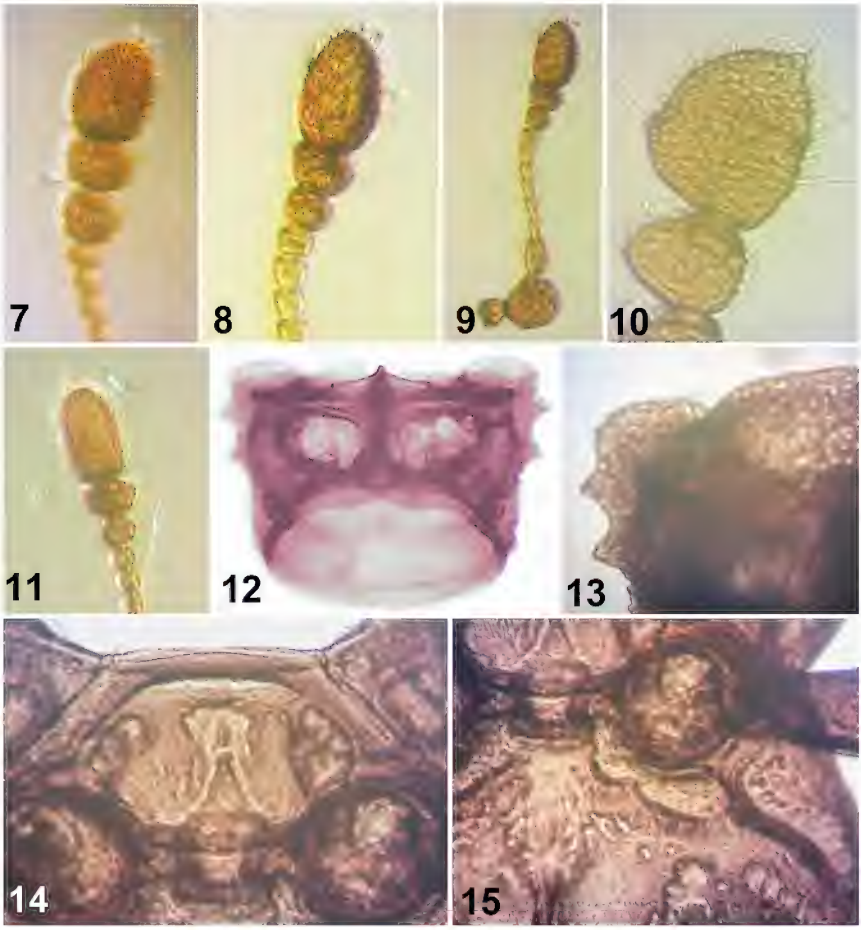
Distribution. Of the 50 described species of *Enicmus*, 37 occur in the Holarctic region, 15 Nearctic and 22 Palaearctic), four Neotropical species are known from Guatemala, Brazil, Argentina and Chile, one species has been described from Indonesia (Sumatra), one from Australia and seven from New Zealand. None have been described from Africa or Madagascar.

Biology. Like virtually all members of the family Latridiidae, species of *Enicmus* are spore feeders, but most known records are from the spore masses of slime moulds (Class Myxomycetes of the Phylum Amoebozoa). The following hosts have been recorded for various *Enicmus* species: *Arcyria nutans* (Bull.) Grev., *Arcyria versicolor* H. Phillips, *Enerthenema papillatum* (Pers.) Rostaf., *Enteridium lycoperdon* (Bill.) M.L. Farr, *Fuligo septica* (L.) F.H. Wigg., *Mucilago cristacea* P. Micheli ex F.H. Wigg., *Stemonitis axifera* (Bull.) T. Macbr., *Stemonitis fusca* Roth and *Tubifera ferruginea* (Batsch) J.F. Gmel. (Lawrence, 1989; Lawrence and Newton, 1980; Lawrence and Milner, 1996; Majka *et al*., 2009; Stephenson *et al*., 1994). One known exception to this host list involves the North American *Enicmus maculatus* LeConte, adults of which were feeding on *Nodulisporium*-type conidia produced by *Biscogniauxia atropunctata* (Schwein.) Pouzar (Ascomycetes: Xylariaceae) on oak (Lawrence 1977).

Enicmus aberrans sp. n.

(Figs 1, 2, 7, 12–15, 16, 20, 22, 26, 27)

Holotype: male, "35.19 S 148.51 E, Wombat Ck 6km NW of Piccadilly Circus, 750m. ACT Oct. 1985 Weir, Lawrence, Johnson / flight intercept window/trough trap / HOLOTYPE *Enicmus aberrans* Lawrence det. J.F.Lawrence 2020" (ANIC).



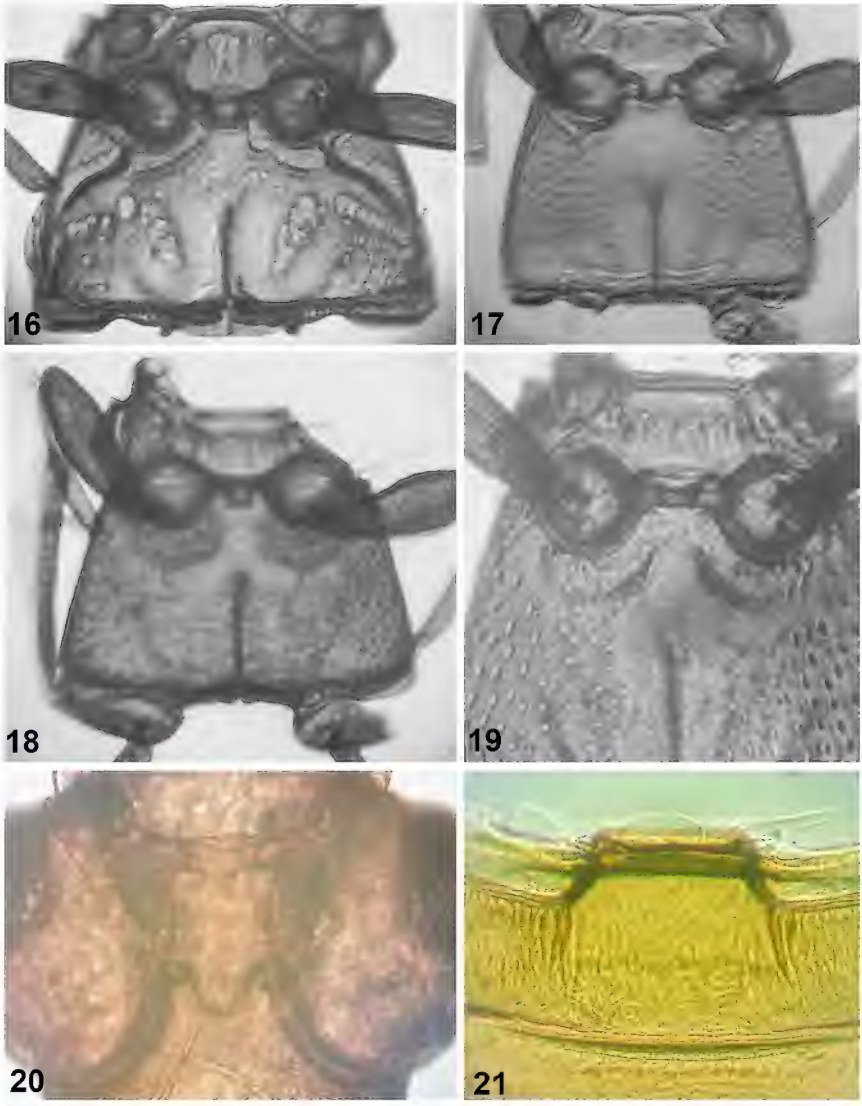
Figs 7–15. *Enicmus* spp.: (7) *E. aberrans* **sp. n.**, antennal club. (8, 9) *E. foveatus* Belon (8) antennal club; (9) antenna. (10) *E. norfolcensis* **sp. n.**, antennal club. (11) *E. notialis* **sp. n.**, antennal club. (12–15) *E. aberrans* **sp. n.**: (12) prothorax, ventral; (13) anterolateral portion of pronotum, dorsal; (14) mesoventrite; (15) metaventrite (part).

Paratypes: **TAS**: Big Sassy Ck, 42°42'S 147°44'E, 12.v.1989, pyr. knockdown, Greenslade, Rounsevell (1, ANIC); Lake Chisholm FR, 41°01'S 145°04'E, 180 m, 12–29.i.1993, FMHD #93-28, ex FIT, AN, MT (1, ANIC); Sandpit FR, 42°43'S 147°50'E, S of Orford, 200 m, 17.i.–2.ii.1983, FMHD #83-45, FIT, AN, MT (2, ANIC); Weldborough, 4.4 km SE, 460 m, 12–13.ii.1980, AN, MT (1, ANIC); Weldborough, 4 km SE, 41°14'S 147°56'E, 13.i.–7.ii.1983, IN, JC (12, ANIC). **VIC**: Acheron Gap, NE Warburton, 37°41'S 145°44'E, 750 m, 27.i.–9.ii.1987, FMHD #87-226, FIT, AN, MT (3, ANIC); Bendoo-Bonang SF, 56 km NNE Orbost, 37°15'42"S, 148°43'49"E, 635 m, 11.i.–11.ii.2005, ANIC 2619, MTp in tree fern gully, C. Lambkin, N. Starick (3, ANIC); Bendoo-Bonang SF, 50 km NNE Orbost, 37°18'25"S, 148°47'7"E, 316 m, 11.i.–11.2.2005, ANIC

2620, MTp in gully, C. Lambkin, N. Starick (1, ANIC); Cement Ck, N Warburton, 37°43'S 145°42'E, 670 m. 26.i.–11.ii.1987, FMHD #87-222, FIT. AN, MT (7, ANIC, FMNH, MVM); same loc., 37°43'S 145°42'E, 670 m, 26.i.–11.ii.1987, pyr. fogging old fungusy logs, AN, MT (1, ANIC); Cement Ck, 500 m, nr. Warburton, 12.v.1970, rotten *Eucalyptus* bark, SJP (1, ANIC); Croajingolong, Sou-West Arm Rd 11 km NW Mallacoota, 37°31'S 149°41'E, 20 m, 10–23.ii.1993, FMHD #93-74, FIT, AN, MT (5, ANIC, FMNH); same loc., 23.ii.1993, fogging *Banksia serrata* trunks, AN, MT (1, ANIC); Cumberland Scenic Res., nr. Cambarville, 37°34'S 145°53'E, 880 m, 17.ii.1993, on *Fuligo* slime mould, AN, MT (1, ANIC); Errinundra NP, Coast Range Rd, 8.8 km E. Jct. Gunmark Rd, 37°17'S 148°57'E, 1020 m, 11–24.ii.1993, FMHD # 93-82, FIT, AN, MT (1, ANIC); Errinundra Plateau, Gap Rd 2.5 km E Bonang Hwy. 37°15'S 148°47'E, 820 m, 18–24.ii.1993, FMHD #93-79, FIT, AN, MT (3, ANIC); Keppel Falls Scenic Res., ENE Marysville, 37°29'S 145°50'E, 780 m, 16–28.ii.1993, FMHD #93-102, FIT, AN, MT (2, ANIC); Lind NP, Eucre Valley at Olive Branch Ck, 37°34'S 148°57'E, 140 m, 10–23.ii.1993, FMHD #93-77, FIT, AN, MT (7, ANIC, FMNH); same loc., 23.ii.1993, pyr. fogging old fungusy logs, AN, MT (1, ANIC); Otway NP, Maits Rest, 38°45'S 143°33'E, 260 m, 25.i.–8.ii.1987, FMHD #87-206, FIT, AN, MT (5, ANIC); Otway NP, Bin Rd, 4.3 km N Cape Horn, 38°43'S 143°35'E, 390 m, 25.i.–8.ii.1987, FMHD #87-210, FIT, AN, MT (6, ANIC); Mt Worth NP, Trevorrows Mill, 38°17'S 146°00'E, 390 m, 28.i.–10.ii.1987, FMHD #87-235, FIT, AN, MT (1, ANIC); Tanjil Bren, 6.1 km ESE, 37°50' S, 143°12'E, 590 m, 29.i.–10.ii.1987, wet scler. forest, FMHD #87-244, FIT, AN, MT (4, ANIC, MVM); Tarra Bulga NP, Grand Ridge Rd at Traralgon Balook Rd, 38°35'S 146°34'E, 690 m, 13–25.ii.1993, FMHD #93-90, FIT, AN, MT (1, ANIC); Warburton, 2.2 km N on Acheron Way, 37°44'S 145°43'E, 320 m, 27.ii.1993, FMHD #93-99, FIT, AN, MT (2, ANIC); same loc., 27.ii.1993, fogging old fungusy logs, AN, MT (1, ANIC); Wilsons Prom. NP, 12.v.1978, leaf and log litter, SJP (1, CMN); Alfred NP, 200 m, 21.v.1978, rotten wood, SJP (1, ANIC); Haines Jct., 1.9 km W on Turtons Track, 38°39'S 143°42'E, 525m, 25.i.–8.ii.1987, FMHD #87-213, FIT, AN, MT (2, ANIC). **ACT:** Blundells Ck, 35°22'S 148°50'E, 23.i.–17.ii.1993, MTp, D.H. Colless (4, ANIC); Blundells Ck, 3 km E Piccadilly Circus, 35°22'S 148°50'E, 850 m, .iii.–.iv.1984, FIT, TW, JL, M. Johnson (4, ANIC); Wombat Ck, 6 km NE Piccadilly Circus, 35°19'S 148°51'E, 750 m, .i.–.iv.1984, FIT, TW, JL, M. Johnson (8, ANIC); same loc., .x.1985, FIT, TW, JL, M. Johnson (8, ANIC). **NSW:** Allyn R., Chichester SF, 32°08'S 151°27'E, 10–11.xi.1981, under dead snake, TW (2, ANIC); Brindle Ck, N Kyogle, 740 m, 29.i.3.iii.1980, JL 80-36, *Stemonitis*, AN, MT (10, ANIC, FMNH); same loc., 29.ii.–3.iii.1980, pyr. fogging *Nothofagus moorei* bark, AN, MT (5, ANIC); Brindle Ck Picnic, Wiangaree, 28°22'S 153°04'E, 760 m, 14.xii.2008, pyr. trees and logs, GM (1, ANIC); Clyde Mtn. 28.v.1978, SJP (1, ANIC); Comboyne, J. Armstrong (1, ANIC); Dingo Tops Forest Park, 57 km NW Wingham, 9–10.xi.1982. 82-94 JL, indet. Myxomycetes, J. and E. Doyen (31, ANIC, CAS, NHML, WR); Gibraltar Range NP, 30.iii.1980, pyr., GM (6, QMB); Kioloa SF, 15 km N Batemans Bay, 35°30'S 150°18'E, 4–5.iii.1986, 86-2 JL, *Stemonitis* sp., J. and N. Lawrence (6, ANIC); same loc., .iii.1987, ex sticky trap, M.G. Robinson (1, ANIC); Lake Burrill, nr. Ulladulla, 1.v.1966, Z. Liepa (1, ANIC); Lorien W. R., 3 km N Lansdowne/Taree, .iii.1987, margin, MTp, G. Williams (3, ANIC); same loc., .xi.1987–.i.1988, margin, MTp, G. Williams (3, ANIC); same loc., .xii.1986, FIT, H. and A. Howden (2, ANIC); Mt Keira Scout Camp,, 34°24.5'S 150°50'E, 320 m, 4–5.iii.1981, 81-3 JLF indet. slime Myxomycetes, JL (1, ANIC); Nadgee SF, Maxwell Ck, 400 m, 13–19.i.1987, D. Bickel (1, ANIC); Toonumbar SF, nr. Grevillia, Murray Scrub, 28°29'S 152°46'E, 770 m, 6.i.1987, ex fungi *Stemonitis*, AN, MT (10, ANIC); Toonumbar SF, nr. Grevillia, Murray Scrub, 28°29'S 152°46'E, 770 m, 6.i.1987,

rotting fruits on ground, AN, MT (1, ANIC); Unumgar SF, Grevillia, Coxs Rd, 28°27'S 152°45'E, 580 m, 2–11.i.1987, FMHD #175, FIT, AN, MT (4, ANIC); Unumgar SF, Grevillia, Coxs Rd, 28°27'S 152°45'E, 580 m, 2–11.i.1987, ANMT 87-19, ex fungi *Stemonitis*, AN, MT (2, ANIC); Unumgar SF, nr. Woodenbong Pole Bridge Rd, 28°24'S 152°40'E, 430 m, 2–11.i.1987, FMHD #172, FIT, AN, MT (12, ANIC); Wiangaree SF, Isakson Ridge, 1050 m, 29.ii.–3.iii.1980, pyr. fogging *Nothofagus moorei* bark, AN, MT (1, ANIC); Wiangaree SF, Sheepstation Ck, 600 m, 29.ii.–3.iii.1980, berlesate leaf and log litter, AN, MT (2, ANIC). **QLD**: Bare Rock, 2 km N Mt Cordeaux, 28°02'S 152°23'E, 1100 m, 31.xii.1993–20.ii.1994, FIT, GM (1, QMB); Big Tableland, NE corner, 15°43'S 145°17'E, 800 m, 20.xii.1990–8.i.1991, FIT, PF, ANZSES Expedition (2, QMB); Binna Burra, Lamington NP, 27.x.1993, *Stemonitis* sp. S.A. Ślipiński, JL (54, AMS, ANIC, CMN, MCZ, NMNH); Blackbutt Range, top of, 26°53'S 152°11'E, 400 m, 24.x.–24. xi.1995, FIT, GM (2, QMB); Bones Knob, 3 km W, 17°13'S 145°25'E, 1100 m, 10. xii.1995, pyr. trees, GM, DC, GT (3, QMB); Brandy Ck, 8 km E Proserpine, 100 m, 21.vi.–10.viii.1982, SBP46 (1, ANIC); Bulburin Barracks, 24°32'S 151°28'E, 580 m, 8.x.1999, pyr. trees, GM (1, QMB); Bunya Mts., Paradise, near road, 26°52'S 151°35'E, 24.x.1997, pyr., bunya and hoop pine logs, GT (1, QMB); Camerons Scrub, gully, 27°31'S 152°44'E, 50 m, vine scrub, 13.i.–16.v.1999, GM (2, QMB); Cape Tribulation, 3 km W, 500 m, 20.ix.–7.x.1982, baited flight trap, GM, D. Yeates, GT (1, QMB); Charmillin Ck, 17°42'S 145°31'E, 940 m, pyr. trees and logs, GM (2, QMB); Charmillin Ck Crossing, Tully Falls Rd, 950 m, 8.xii.1989–5.i.1990, FIT, PF, GM, GT, HJ (2, QMB); Cooran Tableland (barracks), 26°17'S 152°50'E, 400 m, 12.iv.1995, pyr., GM, Koch, GT (3, QMB); Danbulla Sci. Res., 17°12'S 145°40'E, 9.xii.1995, pyr. logs and trees, GM (3, QMB); Eungella, Diggings Rd, 850 m, 24.vi.1988, pyr. knockdown, GM, GT (2, QMB); Eungella, Upper Cattle Ck, 21°02'S 148°36'E, 900 m, 17.xi.1992, pyr., GM, GT, HJ (2, QMB); Granite Ck, Bulburin via Gin Gin, 200 m, 19.vi.–19.viii.1982, SBP42. FIT, SJP (3, ANIC, CMN); Hann Tableland (north end), 16°49'S 145°11'E, 1000 m, 13.xii.1995, pyr. trees and logs, GM, DC, GT (1, QMB); Kirrama Range, Douglas Ck Rd, 800–810 m, .xii.1986–30.ii.1987, FIT and pyr., GM, GT, Hamlet (3, QMB); Kirrama Range, Mt Hosie summit, 930 m, 11.xii.1986, pyr. knockdown, GM, GT, Hamlet (4, QMB); Kirrama SF, 32 km NW Cardwell, 800 m, SPB46, FIT, SJP (4, ANIC); Kuranda SF, 3 km N Kuranda, 360 m, 25.vi.–3.viii.1982, SBP 51, FIT (3, ANIC); Laceys Ck, 10 km SE El Arish, 40 m, 23. vi.–5.viii.1982, SBP47, FIT, SJP (1, ANIC); Lake Eacham, 750 m, 9.xii.1989–14.i.1990, PF and FIT, GM, GT, HJ (2, QMB); Lamb Range, 18 km SE Mareeba, 1200 m, 11. xii.1988, pyr. logs and trees, GM and GT (1, QMB); Lambs Head, 10 km W Edmonton, 1200 m, 10–11.xii.1989, pyr. logs and trees, GM, GT, HJ (1, QMB); Lamington NP, Nagarigoon Area, 21.iv.1995, pyr. trees and trunks, GM (1, QMB); Lamington NP, Westcliff Track, 5.xi.1989, pyr. trees and logs, GM (4, QMB); Lamington NP, IBISCA 700A, 28.188°S, 153.121°E, 29.x.2008, bark spray trees and logs, F. Turco (3, ANIC); Levers Plateau, 28°19'S 152°51'E, 2.xii.1991–6.i.1992, FIT, DC (1, QMB); Longlands Gap BS1, 17°28'S 145°29'E, 1150 m, 4.iv.–2.v.1995, FIT, PZ, L. Umback (5, ANIC); Lower Ballanjui Falls, 28°12'S 153°12'E, 500 m, 3.xii.1995, pyr. dead stump, GM (1, QMB); Lower Coomera, 28°11'S 153°11'E, 350 m, 3.xii.1994–9.i.1995, FIT, GM and HJ (2, QMB); Malaan SF on highway, 17°35'S 145°35'E, 850 m, 22.xi.1994–10.i.1995, FIT, GM and Hasenpusch (2, QMB); Malanda Falls, 750 m, 31.xii.1989, pyr. logs and trees, GM (2, QMB); Malbon Thompson Range, North Bell Peak, 1000 m, 20.xi.1990, pyr. trees and logs, GM (1, QMB); same loc., 600 m, 22.xi.1990, pyr. trees and logs, GM, GT (1, QMB); Mareeba, 20 km SE, Davies Ck Rd, 750 m, 17.xii.1989, pyr. trees and logs, GM, GT (1, QMB); Massey Ck, 17°37'S 145°34'E, 1000 m, 3.i.–4.ii.1995, FIT, PZ (1, ANIC);

Massey Ck BS3, 17°37'S 145°34'E, 1000 m, 4.vii.–3.x.1995, FIT, PZ, L. Umback (2, ANIC); Massey Range, 4 km W Bellenden Ker, 17°16'S 145°49'E, 10.x.1991, pyr., GM, HJ (2, QMB); Mossman Bluff Track, 4–10 km W Mossman, 250, 600, 860 m, 29. xii.1989–15.i.1990, FIT, GM, GT, ANZSES (3, QMB); same loc., 1000 m, 16–30. xii.1988, FIT, GM, GT, ANZSES (1, QMB); Mt Demi summit, 16°30'S 145°19'E, 1000 m, 16.xii.1995–29.i.1996, FIT, GM, GT, Ford (2, QMB); Mt Aberdeen, south summit, 20°12'S 147°53'E, 800 m, 5.xii.1996–8.iv.1997, FIT, GM, DC (2, QMB); Mt Cotton, upper gully, 27°36'S 153°13'E, 150 m, 7.v.1998, pyr. on trees, GM, GT (8, QMB); Mt Deongwar, 3 km S, 27°14'S 152°15'E, 450 m, 14.xi.1998–26.iii.1999, FIT, pyr. GM and DC (11, QMB, ANIC); Mt Dryander, 20°15'S 148°33'E, 650 m, 21.xii.1992–mid.iv.1993, FIT, PF, GM (1, QMB); Mt Finnigan summit, via Helenvale 1050 m, 3–5.xii.1990, pyr., GM, Sheridan, Roberts and GT (2, QMB); Mt Fisher BS2, 17°33'S 145°32'E, 1150 m, 1.xii.1994–3.i.1995, 3.x.–2.xi.1995, PZ, L. Umback (2, ANIC); Mt Glorious, 630 m, 14. xi.1986–3.i.1987, FIT, A. Hiller (6, ANIC); Mt Glorious, 800 m, 28.vi.1978, ex leaf log litter, SJP (1, ANIC); Mt Halcyon, 16°03'S 145°35'E, 870 m, 23.xi.1993, pyr. trees and logs, GM and HJ (1, QMB); Mt Halifax summit, 19°07'S 145°23'E, 21.iii.–10.v.1991, PF and FIT, DC (1, QMB); Mt Hayward, 20°20'S 148°45'E, 350 m, 20.xi.1992–mid.iv.1993, FIT, PF, DC, GM (1, QMB); Mt Haig GS1, 17°06'S 145°36'E, 1150 m, 1.xii.1994–4. ii.1995, FIT, PZ (3, ANIC); Mt Hopeful, 2 km SSE, 23°45'S 150°32'E, 440bm, vine scrub, 27.ix.–15.xii.1999, FIT, D. and I. Cook (1, QMB); same loc., 20.iii.–3.vi.2000, FIT, D. and I. Cook (1, QMB); Mt Lewis, 800 m, 26.xii.1986, FIT, H. and A. Howden (2, ANIC); Mt Lewis, 8 km NW Julatten, 8.i.–2.ii.1987, R. Storey, H. Howden (1, ANIC); Mt Lewis, 20 km W Mossman, 900 m, 26.vi.–1.viii.1982, SBP53, FIT, SJP (1, ANIC); Mt Lewis Rd, 16–22 km from highway, 10.xii.1986–11.i.1987, 950–1000 m, GM, GT, ANZSES (8, QMB); Mt Lewis Rd, 20 km up road, 11.i.1987, FIT, H. Howden, R. Storey (3, ANIC); Mt Lewis, 10 km N, 1100 m, 21.xi.1990, pyr. logs, GM, Sheridan, GT (1, QMB); Mt Lewis, 16 km from Bushy Ck, 16°34'S 145°16'E, 900 m, 20.iv.1997, pyr. tree bases, GM (2, QMB); Mt Macartney, 20°50'S 148°34'E, 900 m, 19.xi.1992, pyr., GM, GT, HJ (1, QMB); Mt Misery summit, 15.878°S, 145.227°E, 860 m, 6.xii.1990–17.i.1991, GM, Sheridan, Roberts, pyr. and FIT (8, QMB); Mt Spec S2, 18°55'S 146°10'E, 880 m, 6.xii.1994–10.i.1995, FIT, MC (1, ANIC); Mt Spec S3, 18°55'S 146°09'E, 880 m, 8.v.–5. vi.1995, MTp, MC (1, ANIC); Mt Spurgeon, 0.5 km NE, 16°27'S 145°12'E, 1180 m, 21.xi.1997, pyr. trees and logs, GM (1, QMB); Mt Spurgeon, 2 km SE via Mt Carbine, 20.xii.1988, 1100 m, pyr. trees and logs, GM and GT (2, QMB); Mt Spurgeon, 2 km SSE, 16°27'S 145°12'E, 1100 m, 19.xi.1997, QM Berlesate 951, stick brushing, DC (3, QMB); Mt Spurgeon, 7 km N, 16°22'S 145°13'E, 1250 m, 17–19.x.1991, pyr. trees and logs, GM and HJ (1, QMB); Mt Superbus summit, 1300 m, 8–9.ii.1990, pyr. trees and logs, GM, GT, HJ (3, QMB); Nangur SF, 28°06'S 151°58'E. 320 m, 24.xi.1995, pyr. trees, GM (1, QMB); Peases Lkt, Eungella, 21°07'S 148°31'E, 900 m, 17.xi.1992–mid.iv.1993, FIT, PF, DC, GM (2, QMB); Ravenshoe SF, Tully Falls Rd, 10.x.–15.xi.1987, FIT, A. Walford-Huggins (1, ANIC); Stanthorpe (1, ANIC); Stony Ck track xing, 21°37'S 148°59'E, 280 m, 17.xii.1999–23.iii.2000, FIT, GM (1, QMB); The Crater NP, tower near, 17°27'S 145°29'E, 1230 m, 25.xi.1994, pyr. trees and logs, GM (3, QMB); The Knobby, 27°30'S 152°35'E, 240 m, vine scrub, 13.i.–6.v.1999, GM (3, QMB); Tomewin Range, Upper Currumbin, 19.x.1989, pyr., trees and logs, GM (3, QMB); Topaz, Hughes Rd, 17°26'S 145°42'E, 650 m, 6.xii.1993–25.ii.1994, FIT, GM, DC, HJ (1, QMB); Tully R. Crossing, 10 km S Koombooloomba Dam, 750 m, 8.xii.1989–4.i.1990, pyr. logs, FIT, PF (2, QMB); Upper Plath Rd, 17°23'S 145°28'E, 1100 m, 9.xii.1995, pyr. trees and logs, GM (5, QMB); Wallaman Falls Rd, 1 km W junction, 18°39'S 145°52'E, 650 m, 5–12.ii.1996,



Figs 16–21. *Enicmus* spp.: (16) *E. aberrans* **sp. n.**, pterothorax, ventral. (17) *E. foveatus* Belon, pterothorax, ventral. (18) *E. notialis* **sp. n.**, pterothorax, ventral. (19) *E. norfolcensis* **sp. n.**, pterothorax, ventral. (20) *E. aberrans* **sp. n.**, head, ventral. (21) *Enicmus foveatus* Belon, first abdominal ventrite.

FIT, GM (1, QMB); Wallaman Falls Rd 600 m, 14.xii.1986–2.i.1987, FIT, GM, GT, Hamlet (2, QMB); Whitfield Range, 16°54'S 145°42'E, 550 m, 28.viii.–19.x.1991, PF and FIT, GM, HJ (2, QMB); Windsor Tableland, 16°14'S 145°00'E, 5.7 km past barracks, 1260 m 8.ii.1998, pyr. trees and logs, GM (1, QMB); Windsor Tableland, 16°15'S

145°02'E, 1.2 km past barracks, 1060 m, 8.ii.1998, GM, DC (2, QMB); Windsor Tableland, 1225–1300 m, 27.xii.1989–9.i.1990, pyr. fogging, E. Schmidt and ANZSES (7, QMB); nr Wallaman Falls, 40 km W Ingham, 600 m 27.vi.–7.viii.1982, SBP 45, FIT, SJP (1, ANIC). **NT:** Lee Point, 2 km SW, 12°22'S 130°52'E, 2.vii.2003, pyr. trees, GM (1, QMB). **WA:** Brockman NP, Pemberton, 26.x.1969, Karri forest, R.W. Taylor (1, ANIC); Manjimup, 35 km WSW, 14–17.vii.1980, SBP115, Berlesate jarrah forest litter, SJP (1, ANIC); Walpole NP, Zigzag Rd, 20–27.vi.1980, SBP708, rotted log litter and fungi, SJP (1, ANIC); Warren NP, 34°28'S 115°58'E, 2.xi.1984, pyr. fogging bark of marri log, J. and N. Lawrence (1, ANIC).

Description. Length 1.2–2.0 mm; subset 1.50–1.80, (1.63) mm (n= 12). Body 1.62–1.88, (1.81) times as long as wide; depth 0.68–0.76 (0.71) times as great as elytral width. Colour red to dark reddish-brown with head and pronotum rarely almost black, legs, mouthparts and antennal funicle usually lighter, but antennal club very dark. Head 1.16 times as long as wide; eye 0.41 times as long as head width; surface of frons and vertex coarsely and irregularly punctate and tuberculate, vertex with curved transverse impression joining ends of temples and joined by weak median longitudinal impression; temples 0.25 times as long as eyes and somewhat rounded; neck 0.73 times as wide as head width behind eyes. Antennae 1.87 times as long as head width; antennomere length ratio: 4.38: 2.13: 1.50: 1.50: 1.50: 1.38: 1.12: 1.00: 2.38: 2.12: 4.50; antennomere length/ width ratios: 1.40; 1.13; 1.33; 1.33; 1.26; 1.16; 0.90; 0.73; 1.00; 0.77; 1.29; scape irregularly oval; club 1.12 times as long as antennomeres 3–8 combined and 2.6 times as long as wide; antennomere 11 equal in length to 9 and 10 combined. Subantennal grooves narrow and partly concealed by genal ridges anteriorly, but widened posteriorly and extending to posterior edges of temples, separated from submentum by genal ridges, which converge posteriorly. Pronotum about 0.63–0.82 (0.72) times as long as wide, widest anteriorly; anterior edge slightly convex between pair of broadly rounded anterolateral lobes produced both anteriorly and laterally; sides each with fine, sinuate lateral carina bearing two teeth just behind anterolateral lobe; sides behind middle slightly converging and very finely denticulate; posterior angles slightly obtuse; posterior edge slightly curved; disc strongly convex anteriorly, moderately so posteriorly, with curved transverse impression at posterior fourth extending between pair of minute sublateral punctures, a broad median longitudinal impression extending from this almost to anterior edge and a narrow posterior, submarginal groove; surface somewhat irregular with coarse, dense shallow punctation and dense microsculpture producing dull sheen. Prosternum in front of coxae 0.67 times as long as length of coxal cavity, each side partly divided transversely by oblique ridge extending to posterior edge of anterolateral lobe; prosternal process almost as wide as mid length of procoxal cavity, strongly carinate with carina extending anteriorly beyond anterior edge of prosternum; apex of prosternal process slightly expanded and subacute; postcoxal processes about as wide as coxal cavity and contiguous above the prosternal process; cavities closed externally and internally. Scutellar shield small and truncate posteriorly. Elytra 1.13–1.41, (1.31) times as long as combined width and 2.34–3.08 (2.69) times as long as

pronotum; sides slightly curved with very narrow margin and apices conjointly rounded; disc distinctly, strongly, more or less evenly convex, with two short transverse depressions at anterior fourth; each elytron with 8 rows of subcircular window punctures enclosed within quadrangular cells, three longitudinal costae separating first three paired puncture rows and an additional carina separating fourth lateral pair from complete epipleuron, which bears an additional row of slightly smaller punctures; costae of third and seventh intervals meeting near apex. Mesoventrite 0.48 times as long as wide, widest posteriorly with truncate anterior edge; intercoxal process subtruncate; mesocoxal cavities separated by 1.27 times diameter of a cavity, laterally closed. Metaventrite 0.58 times as long as wide, widest posteriorly; anterior edge with deep notch for reception of mesoventrital process; surface mesally flat but sharply declined on each side, with pair of curved postcoxal lines extending posterolaterally and a pair of shallow depressions extending from each line to the meso-metaventrital junction; discrimen 0.6 times as long as distance between meso- and metacoxal cavities. Metacoxae separated by 1.67 times shortest diameter of one. Abdomen about as long as wide; first ventrite 1.5 times as long as second, with intercoxal process truncate and with pair of slightly diverging lines extending posteriorly from its base; ventrites 2, 3 and 5 subequal in length, 4 slightly shorter and 5 broadly rounded at apex in both sexes. Aedeagus as in Figs 26–28.

Distribution. Widely distributed in eastern Australia from Tasmania and Victoria through New South Wales to northern Queensland and Northern Territory (near Darwin). Also in the southwestern part of Western Australia.

Biology. Although most specimens were collected by pyrethrum fogging trees and logs and some in flight intercept traps, there are several records from the fruiting bodies of *Stemonitis* sp. (Myxomycetes).

Etymology. The Latin adjective *aberrans*, deviating from the normal, refers to the unusual shape of this species.

***Enicmus foveatus* Belon, 1884**

(Figs 5, 6, 8, 9, 17, 21, 25, 29–31)

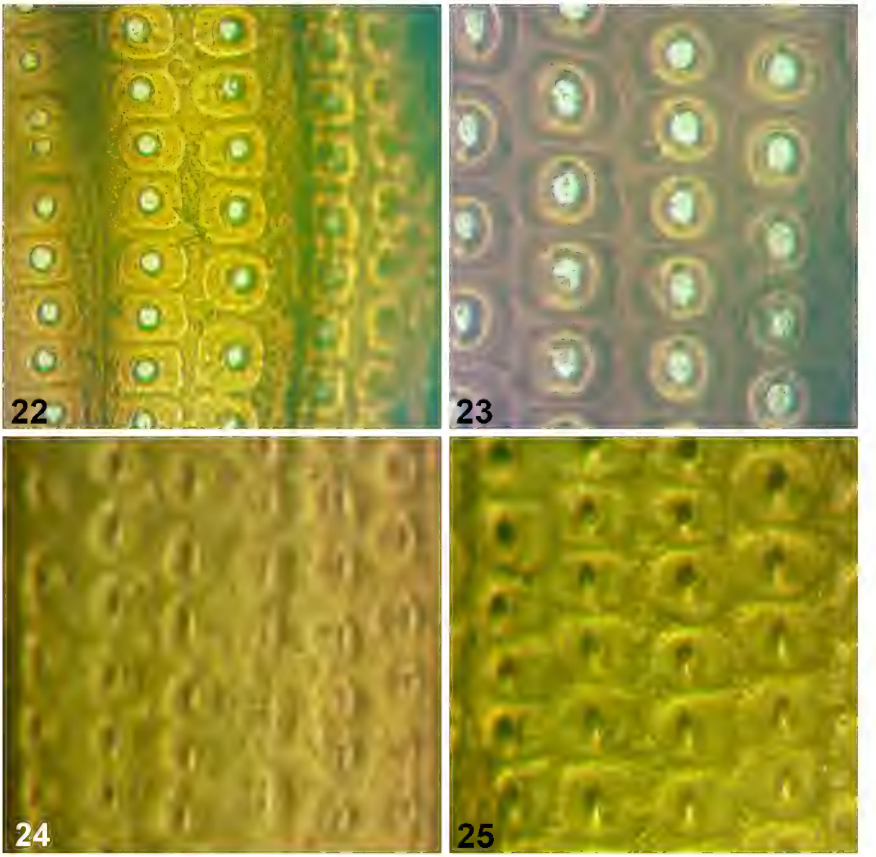
Enicmus foveatus Belon, 1884: 251.

Holotype: Greymouth, New Zealand (MNHN); examined by W. Rücker.

Lathridius denticollis Lea, 1906: 221. Holotype: Huon River, Tasmania (SAM); photo examined, **syn. n.**

Material examined. **TAS:** Bronte Park, 14 km S, 42°15'S 146°29'E, 15.i.–3.ii.1983, MTp/ethanol, IN, JC (5, ANIC); Intake Bridge, 41°19'S 147°56'E, 13–29.i.1983, ex pan trap, IN, JC (1, ANIC); Lake Chisholm FR, 41°08'S 145°04'E, 12–29.i.1993, FMHD #93-23, FIT, AN, MT (2, ANIC); Mt Field NP, Russell Falls, 200 m, 26.i.1989, yellow pans, D. Bickel (1, ANIC); Rosebery, 4 km E, 41°47'S 145°35'E, 16.i.–.ii.1983, MTp/ethanol, IN, JC (1, ANIC); Sandpit FR, S of Orford, 42°43'S 147°50'E, 17.i.–2.ii.1993, FMHD #93-45, FIT, AN, MT (2, ANIC); Schulhofs Rd, 8.7 km NE Upper Blessington, 41°26'S 147°36'E, 870 m, 16.i.–1.ii.1993, FMHD #93-43, FIT, AN, MT (2, ANIC). **VIC**:

Baw Baw Alpine Res., 1 km WNW Alpine Village, 37°50'S 146°16'E, 1420 m, 20.i.–10. ii.1987, FMHD #87-241, FIT, AN, MT (1, ANIC); Baw Baw Alpine Res. 0.7 km NE Neulynes Mill, 37°51'S 146°15'E, 1035m, 14–26.ii.1993, FMHD #93-97, FIT, AN, MT (1, ANIC); Bendoo-Bonang SF, 56 km NNE Orbost, 37°15'42"S, 148°43'49"E, 635m, 11.i.–11.ii.2005, ANIC Bulk Sample 2619, MTp Tree fern gully, C. Lambkin, N. Starick (11, ANIC); Cement Ck, N Warburton, 37°43'S 145°42'E, 670 m, 26.i.–11.ii.1987, FMHD #87-222 FIT, AN, MT (12, ANIC); Coopra Cambra NP, 28 km NNE Cann R., 37°20'20"S, 149°12'43" E, 340 m, 5.xii.2004–12.i.2005, fine MTp across dry creek, C. Lambkin, N. Starick (2, ANIC); Croajingalong NP, Sou-West Arm Rd, 11 km W Mallacoota, 37°31'S 149°41'E, 20 m, 10–23.ii.1993, FMHD #93-74, FIT, AN, MT (3, ANIC); Cumberland Scenic Res. (nr. Camberville), 37°34'S 145°53'E, Cora Lyn Falls Track, 880 m, 17.ii.1993, ex *Fuligo* slime mould on log, AN, MT (3, ANIC); Cumberland Scenic Res. (nr. Camberville), 37°34'S 145°53'E, Cora Lyn Falls Track, 880 m, 17–27. ii.1993, FMHD #93-111, FIT AN, MT (1, ANIC); Errinundra Plateau, Gap Rd 2.5 km E Bonang Highway, 37°15'S 146°15'E, 820 m, 18–24.ii.1993, FMHD #93-79, FIT, AN, MT (1, ANIC); Mt Donna Buang, via Warburton, 18.ii.1967, GM (1, QMB); Mt Margaret Rd at Ghost Point, NNE Marysville, 37°27'S 145°47'E, 1000 m, 16–28.ii.1993, FMHD #93-105, FIT (8, ANIC, FMNH); Mt Margaret Rd at Yanks Folly Track, NNE Marysville, 37°28'S 145°47'E, 750 m, 17–28.ii.1993, FMHD #93-108, FIT, AN, MT (7, ANIC); Mt Sterling Circuit, Rd S Telephone Box Jct., 37°07'S 146°28'E,1270 m, 18.ii.–1.iii.1993, FMHD #93-113, FIT, AN, MT (1, ANIC); Otway NP, Maits Rest, 38°45'S 143°33'E, 260 m, 25.i.–8.ii.1987, FMHD #87-206, FIT, AN, MT (1, ANIC); Tarra Bulga NP, Tarra Valley nr. picnic area, 38°27'S 146°32'E, 340 m, 13–25.ii.1993, #93-87, FIT, AN, MT (1, ANIC); Tarra Bulga NP, Grand Ridge Rd at Traralgon-Balook Rd, 3734'S 146°34'E, 690 m, 13–25.ii.1993, FMHD #93-90, FIT, AN, MT (1, ANIC); Tarra Bulga N.P., Bulga, nr. susp. bridge, 38°26'S 146°34'E, 600 m, 17.ii.1987, ANMT 87-22, *Fuligo* sp., AN, MT (1, ANIC); Warburton, 2.2 km NE on Acheron Way, 37°44'S 145°43'E, 320 m, 15–27. ii.1993, FMHD #93-99, FIT, AN, MT (2, ANIC); Warburton, 12 km E, 215m, 12–16. ii.1980, AN, MT (2, ANIC). **ACT**: Blundells Ck, 35°22'S 148°50'E, 28.i.–17.ii.1993, MTp, D. H. Colless (11, ANIC); Tidbinbilla Nat. Res. 35°28'S 148°53'E, mountain creek trail, 6.xi.1990, ANIC 1126 Berlesate, WD (1, ANIC). **NSW**: Brindle Ck Picnic Area, Wiangaree**,** 28°22'S 153°04'E, 14.xii.2008, pyr. trees and logs, GM (1, ANIC); Broulee, 3551S, 150°11E, 31.xii.1995, M.S. Upton (1, ANIC); Gibraltar Range NP, 30.iii.1980, pyr., GM (1, QMB); Kioloa SF, 15 km NE Batemans Bay, 35°30'S 150°18'E, xii.1986, FIT, M.C. Robinson (2, ANIC); Kosciusko N.P., 4.1 km W Dead Horse Gap, 36°32'S 148°13'E, 1500 m, 19.xii.1986–14.ii.1987, FMHD #86-645, FIT, AN, MT (8, ANIC, FMNH); Kosciusko N.P., 3.5 km NE Guthega, 36°32'S 148°24'E, 1580 m, 18.xii.1986, FMHD #86-643, berlese leaf and log litter, AN, MT (3, ANIC); Kosciusko NP. Leather Barrel Ck picnic area, 38°32'S 148°11'E, 1080 m, .ii.1993, FMHD #93-68, FIT, AN, MT (3, ANIC); Lorien Wildlife Res., 3 km N Lansdowne via Taree, 16–27.xii.1987–7.ii.1988, MTp, G. Williams (20, ANIC); Lower Bucca SF, 14 km NNW Coffs Harbour, 19.xi.1982, J. Doyen (7, ANIC); Unumgar SF, Coxs Rd, nr. Grevillia, 28°27'S 152°45'E, 580 m, 2–11.i.1987, AN,MT 87-19, *Stemonitis*, AN, MT (1, ANIC); Mt Duval, Tin Weir Ck, 15 km NW Armidale, 30°25'S 151°38'E, 1225m, 14–29.iii.1983, ANIC FIT 1445, D.S. Chandler (2, ANIC); Wild Cattle Ck SF, 17 km N Dorrigo, 16.xi.1982, J. Doyen (1, ANIC). **QLD:** Bare Rock, 2 km N Mt Cordeaux, 28°02'S 152°23'E, 1100 m, 31.xii.1993–20.ii.1994, FIT, GM (1, QMB); Benarkin School, 26°53'S 152°09'E, 14.xi.1994–26.i.1995, FIT, GM (1, QMB); Binna Burra, Lamington NP, 27.x.1993, *Stemonitis* sp., S.A. Ślipiński, JL (1, ANIC); Cape Tribulation area, 16°03'–16°05'S 145° 28'E, 1–11.v.1992, under bark



Figs 22–25. *Enicmus* spp., elytral punctation: (22) *E. aberrans* **sp. n.** (23) *E. notialis* **sp. n.** (24) *E. norfolcensis* **sp. n.** (25) *E. foveatus* Belon.

and in rotten logs, JL (2, ANIC); Charmillin Ck Crossing, Tully Falls Rd, 950 m, 8. xii.1989–5.i.1990, PF, FIT, GM, GT, HJ (1, QMB); Garradunga, Polly Ck, 17.454°S, 146.021°E, 126m, 1–13.i.2001, J. Hasenpusch (1, QMB); Garradunga, Polly Ck, 17.458°S, 146.02°E, 58m, 25.xi.–2.xii.2009, GM, F. Turco, J. Hasenpusch (1, QMB); Hann Tableland (north end), 16°49'S 145°11'E, 950–1000 m, GT, DC (1, QMB); Heathlands, 12 km SSE, 11°51'S 142°38E, 26.i.–29.ii.1992, MTp #3, #4, P. Feeney (2, ANIC); Heathlands, 12 km SSE, 11°51'S 142°38'E, 15–26.i.1992, MTp, ethanol, IN, TW (3, ANIC); Hugh Nelson Range GS3, 17°28'S 145°29'E, 1150 m, 1.xii.1994–3.i.1995, MTp and FIT, PZ (3, ANIC); Hurdle Gully, 10.8 km WSW Monto, 24°54'S 151°01'E, 320 m, 20.xii.1997–26.iv.1998, FIT, GM (2, QMB); Isla Gorge, 25°10'S 150°01'E, 350 m, 21.ix.1997, pyr., GM (1, QMB); Karnak-Devils Thumb, 8–12 km NW Mossman, 300 m, 26.xii.1989–15.i.1990, FIT, ANZSES (1, QMB); Keysland, 26°12'S 151°44'E, 5.xii.1994–26.i.1995, FIT, GM (2, QMB); Lake Eacham, 750 m, 9.xii.1989–14.i.1990, PF, FIT, GM, GT, HJ (1, QMB); Longlands Gap BS1, 17°28'S 145°29'E, 1150 m, 1.

xii.1994–3.i.1995, FIT, PZ (1, ANIC); Lower Coomera, 28°11'S 153°11'E, 350 m, 3. xii.1994–9.i.1995, FIT, GM, HJ (4, QMB); Mossman Bluff Track, 4–10 km W Mossman, 600 m, 20.xii.1989–15.i.1990, FIT, GM, GT, ANZSES (8, QMB); Mt Abbot, summit saddle, 20°06'S 147°45'E, 950 m, pyr. trees, GM (1, QMB); Mt Aberdeen, east slope, 20°12'S 147°55'E, 500 m, 7.xii.1996, pyr. hoop pines, GM (1, QMB); Mt Aberdeen, north summit, 20°12'S 147°55'E, 850 m, 5.xii.1996, pyr. trees, GM (1, QMB); Mt Aberdeen, Summit Saddle, 20°12'S 147°53'E, 800 m, 5.xii.1996–8.iv.1997, FIT, GM, DC (1, QMB); Mt Deongwar, 3 km S, 27°14'S 152°16'E, 450 m, 14.x.–30.xii.1998, FIT, GM and DC (4, QMB); same loc., 30.xii.1998–26.iii.1999, FIT, GM and DC (1, QMB); same loc., 30.xii.1998, pyr. trees, GM (1, QMB); Mt Edith GS2, 17°06'S 145°37'E, 1050 m, 1.xii.1994–3.i.1995, MTp, PZ (4, ANIC); Mt Edith GS2, 17°06'S 145°37'E, 1050 m, 1.xii.1994–4.ii.1995, FIT, PZ (4, ANIC); Mt Gavial, 3 km SSW, 23°37'S 150°28'E, 320 m, 17.ix.1999, pyr. trees, GM (7, QMB); Mt Haig GS1 17°06'S 145°36'E, 1150 m, 1. xii.1994–3.i.1945, FIT, PZ (3, ANIC); Mt Hopeful, 2 km SSE, 23°45'S 150°32'E, 440 m (1, QMB); Mt Spec S3, 18°55'S 149°09E, 880 m, 6.xii.1994–10.i.1995, FIT, MC (2, ANIC); same loc., 6.iv.–8.v.1995, FIT, MC (1, ANIC); Mt Spec S3, 19°00'S 146°*11*'E, 880 m, 6.iv.–8.v.1995, FIT, MC (1, ANIC); Mt Spec S1, 19°00'S 146°11'E, 1.xii.1994–3.i.1995, 1.x.–4.xi.1995, FIT, MC (2, ANIC); Mt Spurgeon, 7 km N, 16°22'S 145°13'E, 1250 m, 17–19.x.1991, pyr. trees and logs, GM and HJ (2, QMB); Nangur SF, 26°08'S 151°58'E, 320 m, 24.x.–24.xi.1995, FIT, GM (1, QMB); Paluma Dam Rd, 720–800 m, 17.xi.–8.xii.1990, FIT, GM, Seymour (3, QMB); Peeramon Scrub, 17°19'S 145°37'E, 750 m. 9.xii.1995, pyr. trees, GM (1, QMB); Rundle Range NP, 23°39'S 150°58'E, 15m, 21.iii.2000, pyr. trees, GM (1, QMB); Saddle Mtn., 16°46'S 145°40'E, 640 m, 3.xi.1995, pyr. trees and logs, GM, DC (1, QMB); Spicers Peak summit, 28°06'S 152°24'E, 1200 m, 31.xii.1993–4.iv.1994, FIT, GM (1, QMB); Springbrook, north end, 28°12'S 153°16'E, 550 m, 31.x.–31.xii.1997, FIT, GM (1, QMB); Springbrook Repeater, 28°15'S 153°16'E, 1000 m, 9.i.–19.ii.1995, FIT, GM (1, QMB); The Bluff (Keysland), 26°15'S 151°43'E, 530 m, 29.vii.–23.x.1995, FIT, GM (3, QMB); Tullawallal, Binna Burra, 28°12'S 153°12'E, 950 m, 3.xii.1994–9.i.1995, FIT, GM, HJ (2, QMB); Tully R. Crossing, 10 km S Koombooloomba Dam, 750 m, 6.xii.1989–4.i.1990, PF, FIT, GM, GT, HJ (1, QMB); Upper East Funnel Ck, 21°34'S 149°12'E, 450 m, 16.xi.1992, pyr., GM, GT, HJ (1, QMB); Vine Ck Rd, 17°41'S 145°32'E, 1100 m, 24.xi.1994, pyr. trees and logs, GM (5, QMB); Wallaman Falls, via Ingham, 500 m, 1.x.1980, pyr., GM (1, QMB); West Claudie R., Iron Range, 3–10.xii.1985, pyr. knockdown, GM, DC (2, QMB). **NT:** Lee Point, 2 km SW, 12°22'S 130°52'E, 2.vii.2003, pyr. trees, GM (1, QMB).

Redescription. Length 1.0–1.6 mm; subset 1.30–1.60 (1.47 ± 0.09) mm (n=15). Body 1.89–2.10 (1.95) times as long as wide; greatest depth 0.64–0.74 (0.69) times as great as elytral width. Colour reddish-orange to dark reddish-brown. Head 1.15 times as long as wide; eye 0.5 times as long as head width; surface of frons and vertex coarsely, densely and more or less evenly punctate. without transverse impression; temples 0.16 times as long as eyes, straight and apically abrupt; neck 0.92 times as wide as head width behind eyes. Antennae 1.3 times as long as head width; antennomere length ratio: 3.83: 2.33: 1.50: 1.50: 1.33: 1.29: 1.08: 1.00: 1.50: 1.67: 4.00; antennomere length/width ratios: 1.15; 1.40; 1.28; 1.28; 1.07; 1.00; 0.70; 0.64; 0.50; 0.43; 1.00; club equal in length to antennomeres 3–8 combined and 1.8 times as long as wide; terminal antennomere 1.5 times as long as previous two combined. Subantennal grooves slightly concealed by genal

ridges, anteriorly; genal ridges slightly converging posteriorly. Pronotum about 0.68–0.76 (0.71) times as long as wide, widest at about middle; anterior edge subtruncate; anterior angles rounded and not produced forward; sides each with anterior half laterally produced and explanate, forming lateral lobe the edge of which bears a tooth at the posterior end and sometimes an additional smaller tooth at middle; sides behind middle subparallel; posterior angles right; posterior edge subtruncate; disc slightly convex, with relatively weak longitudinal and curved transverse impressions, the latter with minute puncture at each end; punctation moderately coarse, dense and uniform. Prosternum in front of coxae about 1.12 times as long as length of coxal cavity, weakly convex, without anterior extension of median carina; prosternal process about 0.87 times as wide as mid length of coxal cavity, slightly expanded subapically and narrowly rounded at apex; postcoxal (hypomeral) processes slightly wider than diameter of coxal cavity and contiguous above prosternal process, broadly closing cavities. Scutellar shield 0.15 times as wide as pronotal base, slightly wider anteriorly and truncate at apex. Elytra 1.39–1.58, (1.45) times as long as combined width and 2.61–3.16 (2.90) times as long as pronotum; sides very slightly curved with narrow margins and apices conjointly rounded; disc moderately convex with slightly flattened upper surface, relatively steep sides, eight rows of subcircular window punctures, but with intervals not or weakly raised but with low costae only on intervals 3 and 7; punctures on epipleura very fine; microsculpture very fine so that intervals are shiny. Mesoventrite 0.34 times as long as wide, widest posteriorly with truncate anterior edge; intercoxal process short, slightly transverse and truncate; mesocoxal cavities separated by 1.2 times diameter of a cavity, laterally closed by meeting of ventrites. Metaventrite 0.6 times as long as wide, widest posteriorly; anterior intercoxal lobe broadly emarginate between a pair of short lateral processes; surface moderately convex but declined on each side, with pair of recurved, scalloped postcoxal lines; discrimen 0.68 times as long as distance between meso- and metacoxal cavities. Metacoxae separated by 2.0 times shortest diameter of one. Abdomen about 1.05 times as long as wide; first ventrite 1.45 times as long as second; intercoxal process truncate with moderately long, slightly diverging lines extending posteriorly from base; second to fifth ventrites subequal in length and ventrite 5 (sternite VII) 0.25 times as long as wide and broadly rounded at apex in both sexes. Aedeagus as in Figs 29–31.

Distribution. Eastern Australia from Tasmania to northern Queensland and the Northern Territory (near Darwin); also known from New Zealand.

Biology. Although many specimens have been collected in Malaise traps and flight intercept traps or by pyrethrum fogging, at least some specimens were found in the fruiting bodies of *Stemonitis* sp.and *Fuligo* sp. (Myxomycetes).

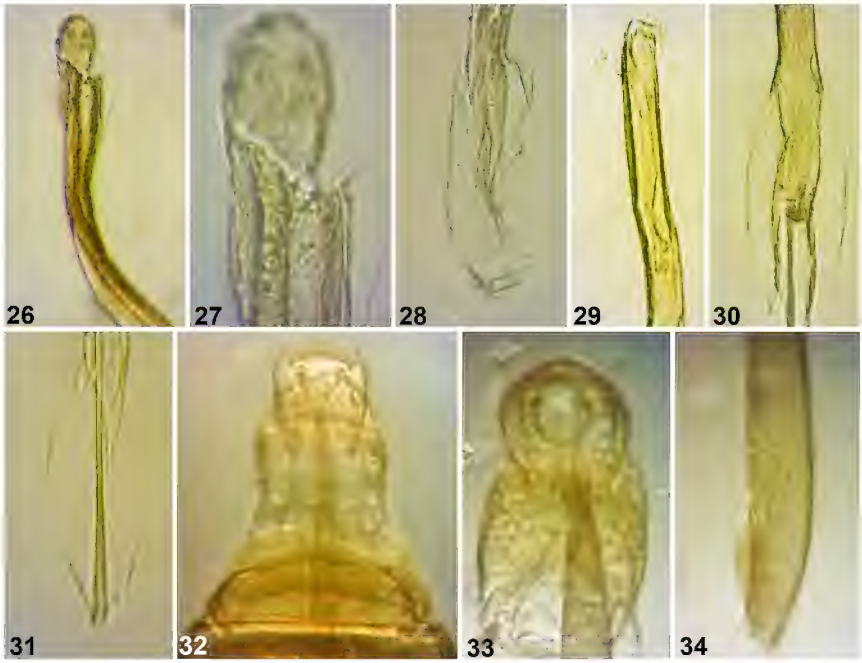
***Enicmus norfolcensis* sp. n.**

(Figs 4, 10, 19, 24, 32–34)

Holotype: male "29.01S 167.57E NORFOLK ISLAND Red Road Track, NINP 14Nov–2Dec. 1984 I.D. Naumann Malaise trap/ethanol" (ANIC).

Paratypes: **NORFOLK ISLAND:** Broken Pine Track, Norfolk Island NP, 29°01'S 167°56'E, 15.xi.1984, L. Hill (1, ANIC); Emily Bay, 30.x.1967, sandy beach, G. Kuschel (1, NZAC); Filmy Fern Walk, Norfolk Island NP, 29°01'S 167°57'E, 14.xi.–2.xii.1984, ANIC 1042, FIT, TW (6, ANIC); Highlands Guesthouse, near, 29°02'S 167°57'E, 20–26. iii.1984, pan trap in palm forest, D.C. Rentz (8, ANIC); Mt Pitt Res., rainforest, 26–30. xi.1979, pyr., GM (1, QMB); Mt Pitt, near, Norfolk Island NP, 29°01'S 167°56'E, Stn 4, 8.iv.1984, FIT, J.E. Feehan (1, ANIC); Palm Glen, 1.xii.1979, pyr. knockdown, GM (2, QMB); Red Road Track, NINP, 29°01'S 167°57'E, 14.xi.–2.xii.1984, MTp/ethanol, IN (10 ANIC); same loc., 14.xi.–2.xii.1984, ex pantraps, IN (1, ANIC); same loc., 14.xi.–2. xii.1984, ANIC 1041, FIT, TW (5, ANIC); Rocky Point Res., 29°03'S 167°55'E, 14.xi.– 2.xii.1984, MTp/ethanol, IN (1, ANIC); same loc., 14.xi.–2.xii.1984, pantraps, IN (1, ANIC); same loc., 14.xi.–2.xii.1984, ANIC 1040, FIT; TW (1, ANIC); South Spur Track (bottom), Norfolk Island NP, 29°15'S 167°56'E, 19.xi.1984, ex ethanol, IN (2, ANIC).

Description. Length 1.2–1.8 mm; (1.45 ± 0.15) mm (n= 11). Body 1.91–2.44 (2.13) times as long as wide; depth 0.65–0.85 (0.72) times as great as elytral width. Colour yellowish-brown to dark reddish-brown with head and pronotum darker than elytra and legs, mouthparts and antennal funicle usually lighter, with antennal club dark. Head as long as wide; eye 0.43 times as long as head width; surface of frons and vertex finely, densely punctate; temples 0.11 times as long as eyes and angulate; neck 0.8 times as wide as head width behind eyes. Antennae 0.64 times as long as head width; antennomere length ratio: 2.58: 1.43: 1.14: 1.14: 1.14: 1.14: 1.14: 1.00: 1.43: 1.43: 2.57; antennomere length/width ratios: 1.29; 1.43; 2.00; 1.60; 1.60; 1.60; 1.60; 1.40; 1.25; 1.00; 1.50; scape subovate, wider near base; club 0.81 times as long as antennomeres 3–8 combined and 3.17 times as long as wide; antennomere 11 much wider than either 9 or 10 and shorter than 9 and 10 combined. Subantennal grooves and genal ridges more or less parallel and extending to posterior edges of temples. Pronotum 0.79–1.00 (0.88) times as long as wide, widest at anterior fourth; anterior edge weakly convex; anterior angles not produced forward; sides each with fine margin and no teeth; posterior angles obtuse and rounded; posterior edge truncate; disc slightly convex anteriorly with curved transverse impression at posterior fourth not extending to sides; surface with coarse, dense shallow punctation and dense microsculpture producing dull sheen. Prosternum in front of coxae 1.1 times as long as length of coxal cavity; prosternal process 0.56 times as wide as mid length of procoxal cavity, with median carina extending anteriorly not beyond anterior edge of prosternum; apex of prosternal process slightly expanded and subacute, but fused to postcoxal processes, which are fused together; cavities closed externally and internally. Scutellar shield less than 0.17 times as wide as pronotal base, slightly widened apically and broadly rounded at apex. Elytra 1.41–1.75 (1.58) times as long as combined width and 2.55–3.29 (2.89) times as long as pronotum; sides slightly curved with very narrow margins concealed anteriorly by elytral humeri; disc slightly convex but steeply sloping laterally, with two short transverse depressions flanking suture at anterior fourth; each elytron with 8 rows of subcircular punctures enclosed within quadrangular cell; without longitudinal costae; epipleuron narrow but complete. Mesoventrite 0.49



Figs 26–34. *Enicmus* spp.: (26–28) *E. aberrans*, **sp. n.**: (26) aedeagal apex; (27) same, detail; (28) aedeagal base. (29–31) *E. foveatus* Belon: (29) aedeagal apex; (30) aedeagus, mid-section; (31) aedeagal base. (32–34) *E. norfolcensis* **sp. n.**, male: (32) abdominal apex; (33) aedeagal apex; (34) aedeagal base.

times as long as wide, widest posteriorly with truncate anterior edge; intercoxal process rounded; mesocoxal cavities separated by 100 times diameter of a cavity, laterally closed. Metaventrite 0.68 times as long as wide, widest posteriorly; anterior edge with deep notch for reception of mesoventrital process; surface mesally flat but slightly declined on each side, a pair of shallow depressions behind and between coxae, defined by curved lines not meeting at midline; discrimen 0.57 times as long as distance between meso- and metacoxal cavities. Metacoxae separated by 2.4 times shortest diameter of one. Abdomen 1.22 times as long as wide; first ventrite 1.27 times as long as second, with intercoxal process subtruncate and without diverging lines; ventrites 2, 3 and 4 each slightly shorter than that preceding it and 5 slightly shorter than 1 with broadly rounded apex. Aedeagus as in Figs 32–34.

Distribution. Restricted to Norfolk Island, which is at 29°S and 1430 km east of Australia.

Biology. Specimens have been collected in flight intercept traps, pan traps and Malaise traps, and by pyrethrum fogging.

Etymology. The species name *norfolcensis* is based on Norfolk Island to which this species appears to be restricted.

***Enicmus notialis* sp. n.**

(Figs 3, 11, 18, 23, 35–39)

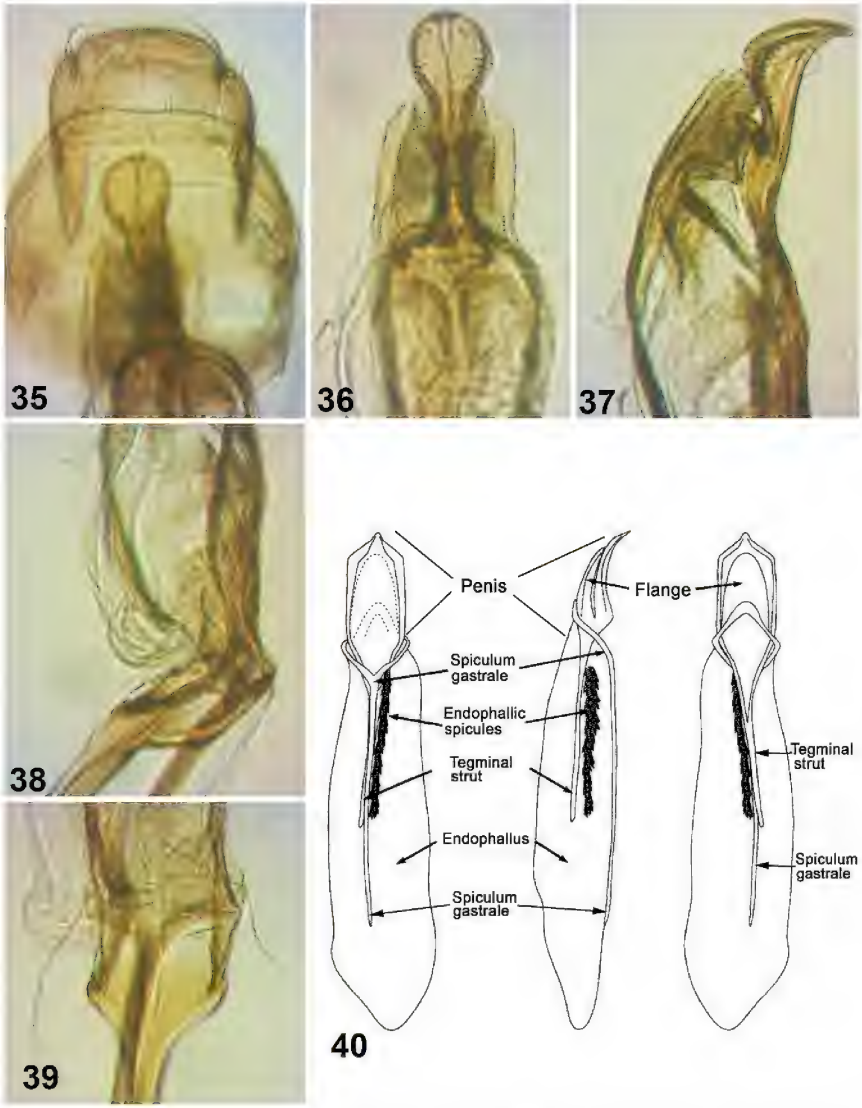
Holotype: male, "41.30 S 145.20 TAS Savage R. Pipeline Rd 20 Apr. 1989 Tube 71 pyrethrin knockdown *Nothofagus*, B. Brown / HOLOTYPE Enicmus notialis Lawrence det. J. F. Lawrence 2020)" (ANIC).

Paratypes: **TAS:** Arve R., 43°09'S 146°48'E, 3.ii.1983, ex yellow tray, IN, JC (7, ANIC); Arve Rd at Arve R., 43°09.525'S 146°43.407'E, 2.ii.2010, sifted moss (1, ANIC); Barrow Ck, 8 km NE Nunarara, 41°21'S 147°22'E, 12.i.–6.ii.1983, IN, JC (1, ANIC); Big Sassy Ck, 42°42'S 147°52'E, 12.v.1989, pyr. knockdown *Atherospermum*, J. Diggle, H. Mitchell, D. Rounsevell (30, ANIC, SAM, MCZ, MVM); Celery Top Islands, Bathurst Harbour, 43°22'S 146°09'E, 7.xii.1990–15.i.1991, FIT, MTp, EN, EE (5, ANIC); same loc., 15.iii.–15.iv.1991, FIT, ANIC 1180, EE, J. Berry (3, ANIC); same loc., 29.v.–29. viii.1991, MTp, M. Comfort (1, ANIC); same loc., 15.i.–20.ii.1991, FIT ANIC 1154, litter, AC, WD (2, ANIC); Claytons, Bathurst Harbour, 43°22'S 146°09'E, 29.viii.–28. xi.1991, MTp, IN, G. Clarke (3, ANIC); same loc., 3.xii.1990–15.i.1991, MTp, EN, EE (4, ANIC); same loc., 12–17.ii.1990, light trap, EN, P. McQuillan (1, ANIC); same loc., 20.ii.–15.iii.1991, FIT, MH, P. McQuillan (1, ANIC); same loc., 15.iii.–15.iv.1991, MTp, EE, J. Berry (1, ANIC); Cradle Mountain Camp Ground, 41°35'S 145°56'E, 880 m, 15.xi.1989, pyr. knockdown, H. Mitchell (1, ANIC); Creepy Crawly Nature Trail, 16.i.2010, moss on logs (1, ANIC); Franklin R., 31°14'S 146°01'E, 22.i.1983, IN, JC (1, ANIC); Frodsham Pass, 2 km S, 42°50'S 146°23'E, 24.i.1983, ex yellow tray, IN, JC (4, ANIC); Geeveston, 10 km W, 43°09'S 146°47'E, 14.ii.1992, T. Gush (3, ANIC); Gordon R. Rd nr. Little Florentine R., 440 m, 3.ii.1980, under bark rotten logs, AN, MT (4, ANIC); Hartz Mts., Edwards Rd, 43°07'S 146°47'E, 7.i.–1.ii.1983, IN, JC (1, ANIC); Hartz Mts. NP, Hartz Rd 740 m, 8–10.ii.1980, berlese, leaf litter, AN, MT (1, ANIC); Hellyer Gorge, N. side, 280 m, 18.ii.1980, berlese leaf litter, AN, MT (1, ANIC); Hellyer Gorge, 41°16'S 145°17'E, 17.i.1983, IN, JC (1, ANIC); Huon Camping Area, 43°03'S 146°17'E, 25.i.1983, yellow tray, IN, JC (12, ANIC); Kermandie R. Val., Penny Rd area, 43°22'S 146°88'E, .ii.–.iii.2002, FT44078, S. C. Baker (1, ANIC); Lake Chisholm FR, 41°08'S 145°04'E, 180 m, 12–29.i.1993, FMHD #93-28, FIT, AN, MT (6, ANIC); Lake St. Clair, 42°06'S 146°10'E, 750 m 25–27.i.1980, pyr. spray tree ferns, JL, TW (1, ANIC); Lake St. Clair, W side, 750 m, 25–29.i.1980, FIT, AN, MT (3, ANIC. FMNH); Lake St. Clair, W side, 750 m, 25–29.i.1980, berlese, leaf litter, AN, MT (1, ANIC); Lower Gordon R., 42°43'S 145°45'E–145°50'E, 1977–1978, moss, litter, Howard, Hill (4, ANIC); Melaleuca, nr. Bathurst Harbour, 43°25'S 146°10'E, 15.i.–12.ii.1991, MTp, AC, WD (4, ANIC); same loc., 7.xii.1990–15.i.1991, MTp, FIT. EN, EE, 13, ANIC); same loc., 20.ii.–15.iii.1991, MTp, MH, P. McQuillan (7, ANIC); same loc., 15.iii.–15.iv.1991, MTp, EE, J. Berry (2, ANIC); same loc., 15–20.ii.1991. MTp, AC, WD (1, ANIC); same loc., 20.ii.–15.iii.1991, FIT, MH, P. McQuillan (1, ANIC); same loc., 29.viii.–28.xi.1991, MTp, IN, G. Clarke (2, ANIC); same loc., 25–29.xi.1991, yellow pans, *Leptospermum* thicket, IN (3, ANIC); same loc., 12–17.ii.1990, yellow trays in *Leptospermum* scrub, IN (1, ANIC); same loc., .ii.1990, MTp, yellow pans, IN (2, ANIC); same loc., 3.xii.1990–5.i.1991, MTp, EN, EE (3, ANIC); Mt Barrow, 11 km E, 41°23'S 147°25'E, 30.i.–6. ii.1983,pan trap, IN, JC (3, ANIC); Mt Barrow Rd, 780 m, 15–17.ii.1980, AN, MT (1, FMNH); Mt Barrow Rd, 890 m, 15–17.ii.1980, AN, MT (1, ANIC); Mt Field NP, 42°41'S 146°43'E, 160–240 m, 4.ii.1980, JL 80-18, indet. fungus, JL, TW (1, ANIC); Mt Field

NP, Lake Dobson Rd, 610 m, 30.i.1980, berlese leaf litter, AN, MT (1, ANIC); Mt Field NP, Lake Dobson Rd, 42°41'S 146°40'E, 710 m, 31.i.1980, JL, TW (2, ANIC); Mt Field NP, Lake Dobson Rd, 240 m, 31.i.–5.ii.1980, AN, MT (2, ANIC); Mt Field NP, near Lake Fenton, 42°41'S 146°37'E, 1000 m, 31.i.1980, JL, TW (1, ANIC); Mt Field West, 7 km WNW, 42°38'S 146°26'E, 460 m, 1.ii.1980, under bark rotten log, JL, TW (2, ANIC); Mt Mangana, Bruny I., 43°21'S 147°13'E, 4.iv.1989, pyr. knockdown *Phyllocladus*, P. Greenslade, J. Diggle (4, ANIC); Mt Mangana, Bruny I., 43°21'S 147°13'E, 4.iv.1989, pyr. knockdown dead trees, P. Greenslade, J. Diggle (5, ANIC); Mt Michael, 41°11'S 148°00'E, 740 m, 26–27.xi.1989, pyr. knockdown, R. Coy, H. Mitchell (15, ANIC); Mt Murchison, 41°50'S 145°37'E, 18.iv.1989, pyr. knockdown *Nothofagus*, B. Brown, L. Robertson (3, ANIC); Mt Oakleigh, 4 km S, 41°51'S 146°03'E, 800 m, 13.ii.–7.iii.1991, FIT ANIC 1157, IN, MH (2, ANIC); Mt Ossa, 2 km NEbyN, 41°52'S 146°03'E, 1000 m, 15.ii.–7.iii.1991, FIT, ANIC 1158, IN, MH (2, ANIC); same loc., 30.xi.1990–8.i.1991, FIT, ANIC 1146, EN, EE (2, ANIC); Mt Victoria, 41°20'S 147°50'E, 900 m, 24.xi.1989, pyr. knockdown, H. Mitchell (2, ANIC); Mt Wellington, Shoebridge Bend, 42°54'S 147°15'E, 5.ii.1983, IN, JC (1, ANIC); Murchison Hwy. State Res., Que R. Mine Rd, 41°38'S 145°41'E, 880 m, 11–27.i.1993, FMHD #93-22, FIT, AN, MT (3, ANIC); Nunamara, 10 km ENE, 41°22'S 147°24'E, 12.i.–6.ii.1983, IN, JC (6, ANIC); Pelion Hut, 3 km S Mt Oakleigh, 41°50'S 146°03'E, 860 m, 8.i.–12.ii.1991, MTp, AC, WD (6, ANIC); same loc., 8.i.–12.ii.1991, FIT, litter, AC, WD (6, ANIC); same loc., 30.xi.1990–8.i.1991, FIT, litter, EN, EE (11, ANIC, CAS); same loc., 30.xi.1990–8.i.1991, MTp, EN, EE (9 ANIC); same loc., 12–15.ii.1991, ex yellow pan traps, AC, WD (1, ANIC); same loc., 28–30.xi.1990, on grass and low vegetation, T. A. Weir (2, ANIC); same loc., 7.iii.–9. iv.1991, MTp, EE, J. Berry (1, ANIC); same loc., 5–10.ii.1990, IN (3, ANIC); same loc., .iv.–.v.1992, pyr. knockdown log and tree roots *Nothofagus*, P. Greenslade, M. Comfort (12, ANIC); same loc., 8.i.–12.ii.1991, MTp, AC, WD (11, ANIC); Pelion Hut, 3 km S Mt Oakleigh, 41°50'S 146°03'E, 860 m, 13.ii.–7.iii.1991, FIT, IN, MH (1, ANIC); same loc., 28–30.xi.1991, ex yellow pan traps, IN (1, ANIC); same loc., 5–10.ii.1990, MTp, IN (9 ANIC); same loc., .iii.1991, crepuscular sweeping, IN (2, ANIC); same loc., 26.ix–9.xi.1991, FIT Smith/Thomas (1, ANIC); Pirates Rd, Tasman Pen., 16.iii.1989, pyr. knockdown, P. Greenslade, J. Diggle (4, ANIC); Queenstown, 55 km ESE, Lyell Hwy., 400 m, 19–22.ii.1980, berlese, leaf litter, AN, MT (6, ANIC); Rosebery, 4 km E, 41°47'S 145°35'E, 16.i.–1.ii.1983, IN, JC (3, ANIC); Russell Falls, Mt Field NP, 200 m, 26.i.1989, yellow pans, D. Bickel (4, ANIC); Sandpit FR, S of Orford, 42°43'S 147°50'E, 200 m, 17.i.–2.ii.1993, FMHD #93-45, FIT, AN, MT (2, ANIC); Savage R. Pipeline Rd, 41°30'S 145°20'E, 20.iv.1989, pyr. knockdown *Anodopetalum*, J. Diggle (6. ANIC); same loc., 12.v.1989, pyr. knockdown *Atherospermum*, P. Greenslade, H. Mitchell, D. Rounsevell (5. ANIC); same loc., 20.iv.1989, pyr. knockdown *Nothofagus*, J. Diggle, B. Brown, P. Greenslade (20, ANIC); same loc., 20.iv.1989, pyr. knockdown *Eucryphia*, B. Brown (1. ANIC); Saxons Rd, 41°18'S 145°36'E, 17.i.–1.ii.1983, ex pantrap, IN, JC (19, ANIC); St. Columba Falls, 315m, 12–14.ii.1980, AN, MT (2, ANIC); Schulhofs Rd 8.7 km NE Upper Blessington, 41°26'S 147°36'E, 870 m, 16.i.–1.ii.1993, FMHD #93-43, FIT, AN, MT (4, ANIC); Tahune Forest Park, 43°06'S 146°43'E, 3.ii.1983, IN, JC (2, ANIC); The Gap, Florentine Valley, 15 km WNW Maydena, 600 m, 1.ii.1980, pyr. fogging *Nothofagus cunninghami* bark, AN, MT (3, ANIC); Thumbs Parallel Gullies, 42°35'S 147°28'E, 1.ix.1989, pyr. knockdown, sassafras, R. Coy (1, ANIC); Wandle R., 10 km NNE Waratah, 1.ii.1983, IN, JC (1, ANIC); Weldborough, 4 km SE, 41°14'S 147°56'E, 13.i.–7.ii.1983. IN, JC (5, ANIC); Weldborough, 4.4 km SE, 460 m, 12–14.ii.1980, AN, MT (2, ANIC); Wilmont, 14 km WbyS, 41°30'S 146°05'E, 31.i.1983, IN, JC (1, ANIC). **WA**: Coalmine

Beach, Walpole Nornalup NP, 34°59'S 116°44'E, 25–28.x.1984, fogging bark of standing dead *Casuarina*, J. and N. Lawrence (1, ANIC).

Description. Length 1.4–2.3 mm; subset 1.45–2.25 (1.85 ± 0.23) mm (n= 18). Body 1.90–2.07 (1.97) times as long as wide; depth 0.57–0.70 (0.63) times as great as elytral width. Colour dark reddish-brown to black. Head 1.1 times as long as wide; eye 0.32 times as long as head width; surface of frons and vertex coarsely and irregularly punctate and somewhat rugose, vertex without curved transverse impression; temples 0.67 times as long as eyes, straight with concave surface and abruptly diagonal at apex; neck 0.73 times as wide as head width behind eyes. Antennae 1.35 times as long as head width; antennomere length ratio: 3.57: 2.14: 1.14: 1.43: 1.57: 1.29: 1.14: 1.00: 1.14: 1.43: 4.29; antennomere length/width ratios: 1.25; 1.36; 1.14; 1.82; 1.57; 1.29; 1.00; 0.78; 0.47; 0.43; 1.25; scape globular; club equal in length to antennomeres 3–8 combined and 2.13 times as long as wide; terminal antennomere about 1.5 times as long as previous two combined. Subantennal grooves almost entirely concealed by genal ridges, widened posteriorly and extending to posterior edges of temples; genal ridges subparallel. Pronotum about 0.61–0.72 (0.67) times as long as wide, widest at anterior fourth; anterior edge subtruncate between pair of broad, flattened, lobes produced both anteriorly and laterally and broadly rounded at apex; sides each with anterior half curved and posterior half straight and subparallel; posterior angles right; posterior edge subtruncate; disc slightly convex with weak transverse submarginal impression, a pair of fine, irregular and usually interrupted longitudinal carinae extending from base almost to apex and a pair of fine, circular, sublateral pits at posterior three-fifths, with intervals somewhat shiny. Prosternum in front of coxae about 0.9 times as long as length of coxal cavity, weakly convex with median carina not reaching anterior edge; prosternal process about 0.5 times as wide as mid length of coxal cavity, slightly expanded subapically and narrowly rounded at apex; postcoxal (hypomeral) processes about 0.7 times as wide as coxal cavity and contiguous above prosternal process, broadly closing cavities. Elytra 1.45–1.59 (1.51) times as long as combined width and 3.08–3.65 (3.31) times as long as pronotum; sides very slightly curved with very narrow margin and apices conjointly rounded; disc moderately convex, with upper surface slightly convex with two short, weak, transverse depressions flanking suture at anterior fifth, a larger mesal impression at posterior fourth, and relatively steep sides; each elytron with 8 rows of subcircular window punctures enclosed within quadrangular cells, three longitudinal costae separating first three paired puncture rows and an additional carina separating fourth lateral pair from complete epipleuron, which bears an additional row of smaller punctures; costae of third and seventh intervals meeting near apex; microsculpture very fine so that intervals are shiny. Mesoventrite 0.48 times as long as wide, widest posteriorly with truncate anterior edge; intercoxal process short, slightly transverse and truncate; mesocoxal cavities separated by 0.95 times diameter of a cavity, laterally closed by meeting of ventrites. Metaventrite 0.64 times as long as wide, widest posteriorly; anterior edge with broad emargination; surface slightly convex but



Figs 35–40. Latridiidae: (35–39) *Enicmus notialis* **sp. n.**: (35) abdominal apex and aedeagus, dorsal; (36) aedeagal apex, ventral; (37) same, lateral; (38) aedeagus mid-section, lateral; (39) same, dorsal. (40) *Corticaria* sp., aedeagus, dorsal, lateral and ventral with parts labelled.

sharply declined on each side, with pair of recurved postcoxal lines meeting at midline and forming the bisinuate edge of a shallow cavity; discrimen 0.75 times as long as distance between meso- and metacoxal cavities. Metacoxae separated

by 2.6 times shortest diameter of one. Abdomen about 1.2 times as long as wide; first ventrite 1.3 times as long as second, with intercoxal process truncate and without diverging lines extending from base; second ventrite 0.8 times as long as first, 3 to 5 subequal in length, and ventrite 5 (sternite VII) 0.25 times as long as wide, very broadly rounded at apex in both sexes. Aedeagus as in Figs 35–39.

Distribution. Widely distributed in Tasmania, with a single record from southern WA.

Biology. Specimens have been collected in various ways, including in flight intercept traps, pan traps and Malaise traps and by pyrethrum fogging.

Etymology. The Latin adjective *notios*, southern, refers to the southern distribution of the species.

Notes. The distribution of this species is somewhat unusual with only a single record outside of Tasmania. The species also differs in several respects from all other Australian *Enicmus* and is similar to *Enicmus transversithorax* Dajoz 1967 described from the Araucania and BioBio Districts of Chile. This Chilean species differs from *E. notialis* in having two pairs of lateral pronotal teeth, shorter temples, shorter terminal antennomere and a much simpler aedeagus.

Enicmus sp. (Christmas Island)

Material examined. **CHRISTMAS ISLAND**. 10°30'S 105°35'E, East West Park Track, 13–29.iv.1989, MTp/ethanol, J.C. Cardale (1♀, ANIC).

Remarks. This species appears to be related to *Enicmus aberrans* sp. nov., but differs in several respects, as indicated in the key. It looks similar to *Enicmus callosus* Rücker, 1985) and may be related to that Sumatran species. The species is not described here based on only one completely dissected female.

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greatly improving the manuscript, H.E.J. Hammond and C.S. Hartley for advice on Latridiidae, and to the late Fred Andrews for a preliminary sorting of the ANIC material.

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AFTER THE BLAZE: BUSHFIRE RECOVERY SURVEY FINDS A NINTH SPECIES OF *WATKINSIA* BRITTON, 1995 (COLEOPTERA: SCARABAEIDAE: MELOLONTHINAE: DIPHUCEPHALINI)

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Abstract

Watkinsia incendiala **sp. n.** is described from males collected at Bulburin National Park, south of Miriam Vale, Queensland, and is compared with the other eight known species of the genus. The species' occurrence in notophyll vine forest is consistent with that of the other species that are found in 'islands' of high-altitude rainforest from central Queensland to north-central New South Wales.

Key words: Australia, nomenclature, taxonomy, classification, melolonthines

Introduction

Within the Scarabaeidae, the melolonthine tribe Diphucephalini Laporte, 1840 is characterised by metallic green, red or blue colouring, the pronotal disc with a deep, circular fovea on each side near the mid-lateral angle, strong, 'bifid' claws and metatibiae with 2, 1 or 0 apical spurs (Britton 1957). The tribe is endemic to Australia (Evans and Smith 2020) and comprises three genera: *Diphucephala* Dejean, 1821, *Cunderdinia* Lea, 1916 and *Watkinsia* Britton, 1995 (Britton 1995; Weir *et al.* 2019). Adults of *Watkinsia* are known to fly in daylight in high-altitude rainforest in northern New South Wales and central and southern Queensland (Britton 1995), with the genus crossing the Saint Lawrence Gap in central Queensland and arcing to the west of the Brisbane Valley Barrier in south-eastern Queensland (Bryant and Krosch 2016) and continuing into New South Wales. Eight species were recognised by Britton (1995), each from geographically restricted localities (Fig. 6).

Following the Black Summer Fires of 2019–20, the Queensland Department of Environment and Science undertook surveys of priority threatened species across south-eastern Queensland, supported through the Australian Government's 'Bushfire recovery package for wildlife and their habitat'. The Queensland Museum provided expertise to survey invertebrates across unburnt and fire-impacted rainforest areas, including complex notophyll vine rainforest at Bulburin National Park, approximately 25 km south of Miriam Vale. From these surveys, I am here able to describe a ninth species of *Watkinsia* collected in both burnt and unburnt rainforest habitats.

Methods

I adhere to the phylogenetic species concept as outlined by Wheeler and Platnick (2000). This concept defines species as the smallest aggregation of populations diagnosable by a unique combination of character states. Label data of the new species are given in full, with a '|' separating different labels and explanatory comments given in square brackets. The maps were prepared using Cartographer 1.51 (Maddison and Maddison 2017). The images were made using a Canon EOS

5D camera body mounted with a Canon EF 200 mm macro lens. Image stacking was done using Zerene Stacker software and post-processing in Photoshop.

Watkinsia Britton, 1995

Watkinsia Britton, 1995: 116. Type species: *Watkinsia bella* Britton, 1995, by original designation.

Diagnosis. Metallically coloured; labrum hidden below clypeus and separated by a curved groove; anterior edge of clypeus (viewed from above) truncate and with lateral edges constricted towards the base; antennae with 8 antennomeres including club of 3 short lamellae; frons narrow between the eyes (ratio of distance across eyes to minimum width between eyes >1.8:1); metatibiae with one or no apical spur; claws testaceous, bifid, basal ramus of bifurcation wider at base than apical ramus and usually truncate; parameres asymmetrical and expanded laterally towards apices.

Watkinsia incendiala sp. n.

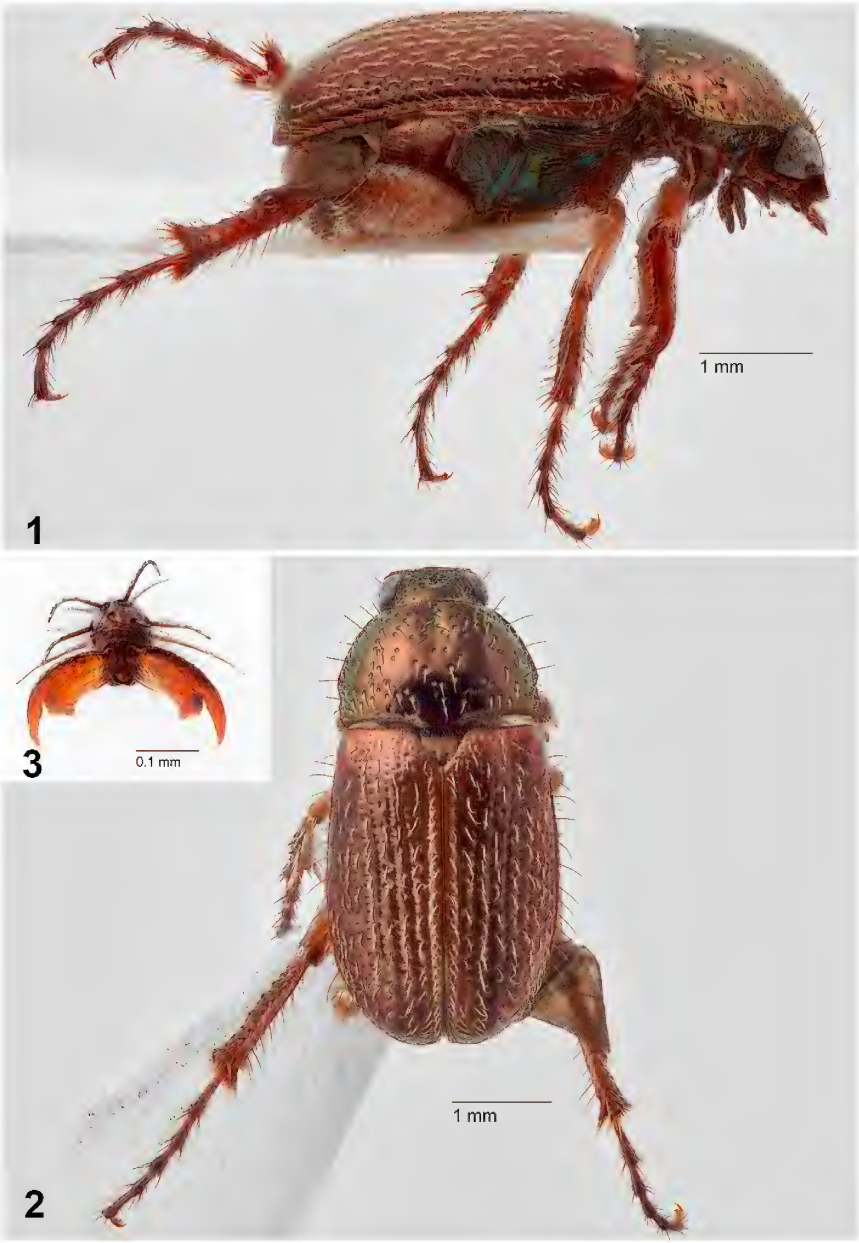
(Figs 1–6)

urn:lsid:zoobank.org:act:52581817-930C-43F9-B1FB-0A7E74ED0F4B

Type series. Holotype ♂, QUEENSLAND, 24.547°S x 151.545°E Bulburin NP [National Park], Bobby Range Road, unburnt site, 625 m, 3–5.xi.2020, 39932, C. Lambkin and T. Churchill, 3 yellow pans, rainforest (NVF) [notophyll vine forest] | Bushfire Recovery Project QM-DES 2020 39932 (Queensland Museum, registered number T250609).

Paratypes. QUEENSLAND: 1♂, 24.547°S x 151.546°E Bulburin NP, Bobby Range Road, severe burn site, 620 m, 3–8.xi.2020, 39936, C. Lambkin and T. Churchill, Malaise, rainforest (NVF) | Bushfire Recovery Project QM-DES 2020 39936; aedeagus and abdomen on cards attached to pin (Queensland Museum, registered number T250610); 1♂, 24.598°S x 151.511°E, Bulburin NP, Dawes Range Rd, moderate burn site, 660 m, 4–9.xi.2020, 39948, C. Lambkin, T. Churchill, Malaise, rainforest (NVF) | Bushfire Recovery Project QM-DES 2020 39948 (Queensland Museum, T250611); 1♂, 24.555°S x 151.555°E, Bulburin NP, Bobby Range Road, moderate burn site, 3–8.xi.2020, 39942, C. Lambkin, Malaise, rainforest (NVF), 600 m | Bushfire Recovery Project QM-DES 2020 39942 (Queensland Museum, T250617).

Description. Male (Figs 1–5). Length 4.7–4.9 mm. *Head.* Labrum below clypeus, testaceous, with scattered fine setae; clypeus with anterior face brown and with row of fine setiferous punctures, upper surface black with slight copper-green tinge and anterior margin testaceous to black, upper surface coarsely punctured with a few short, fine setae, ratio of maximum width to mid length of upper clypeus 2:1; maxillary palpi brown, terminal segment fusiform; mentum black; antennae with antennomeres 1–5 brown, lamellae darker with metallic sheen, length of terminal lamella 0.5 mm; clypeofrontal ridge raised, transverse; frons dark metallic green to black with coppery reflections, surface coarsely punctured except towards posterior margin, each puncture with a minute seta and with few long setae on inner margin of each eye, surface with median shield-shaped depression bounded on each side by a low ridge, between eyes as wide as median



Figs 1–3. *Watkinsia incendiala* **sp. n.** male holotype: (1) lateral view; (2) dorsal view; (3) metatarsal claws. © Queensland Museum as QMDIU_03265, QMDIU_03264 and, QMDIU_03283, respectively.

length, eyes moderately large, ratio of width across eyes to minimum width between eyes 1.9:1, ratio of length to width of eyes (viewed from above) 2:1, eyes in lateral view truncate posteriorly. *Pronotum* black with coppery reflection; ratio of posterior width to mid length 1.6:1, ratio of width at anterior margin to width at posterior margin 1.9–2:1, disc coarsely punctured, especially towards the sides and down the mid line, each puncture with a white, backwardly-directed seta about 0.2 mm long, disc with a shallow, median longitudinal depression on anterior half, anterior and posterior margins defined by a continuous low ridge, laterally evenly curved outwards to about two-thirds length then indented slightly before continuing to well-defined posterior angle, a fovea laterally about three-fifths towards posterior angle. *Scutellum* shining brown, surface smooth and glabrous. *Elytra* shining dark brown with copper-green reflections, disc with 8–9 rows of punctures continuing to apices, rows more confused laterally, many with a white, curved, backwardly-directed seta (some obviously rubbed off) that are similar to those on pronotum but more curved towards apex, epipleurae with row of long, brown setae. *Pygidium* yellow-brown basally, dark brown along apical parts of lateral margin, disc with dense, white, short setae. *Ventral surface* with thorax with green reflections, abdomen dark brown, thorax with fine, white setae, abdomen with coarser, brown setae. *Legs* with coxae and femora yellowish-brown, tibiae and tarsi dark brown, protarsi with tarsomeres 2 and 3 more expanded than tarsomere 4, metafemur 2.4 times as long as wide, metatibiae without apical spurs, tarsal claws bifid (Fig. 3) with the apical ramus thin and pointed, basal ramus shorter, much thicker and with apex deflexed. *Aedeagus* (Figs 4, 5) asymmetrical, right paramere rounded towards apex, left paramere more expanded laterally near apex, more club-shaped and hooked at apex.

Female. Unknown.

Etymology. The specific name is an adjective derived from the Latin *incendialis*, of fire, in recognition of the extensive but poorly documented impacts of the Black Summer 2019–20 wildfires on Australian native invertebrate fauna.

Distribution (Fig. 6). Known only from the Bulburin National Park; this encompasses the catchments for the Boyne and Kolan Rivers and Baffle and Granite Creeks. Subtropical rainforest and dense stands of dry rainforest with emerging hoop pines (*Araucaria cunninghamii*) cover half of Bulburin and, together, they form the largest remnant of complex notophyll rainforest in central Queensland.

The distinctive and endemic nature of the insects of the Bulburin Plateau was first noted by Darlington (1961) who recognised it as an "Isolated Australian Faunule" in his study of the latitudinal transition of rainforest Carabidae along the east coast of Australia. He used the old name of 'Mt Jacob' that predates the modern name of Bulburin for the plateau (G.B. Monteith *pers. comm.*).

Remarks. The eight previously described species of *Watkinsia* fall into two groups, one with long black setae on the frons and with the tips of the near-the

Figs 4, 5. *Watkinsia incendiala* **sp. n.** male paratype: (4) parameres, left lateral view; (5) parameres, dorsal view. © Queensland Museum as QMDIU_03271 and QMDIU_03284, respectively.

symmetrical parameres each tapering to a rounded point (Britton 1995, Figs 17–19) (*W. bella* Britton, 1995, *W. monteithi* Britton, 1995 and *W. sedlaceki* Britton, 1995), and the other with, at the most, short, pale semi-erect or curved pale setae on the frons and with the parameres asymmetrical with one paramere club-shaped (Britton 1995, Figs 19–22) (*W. macrops* (Lea, 1924), *W. megalops* Britton, 1995, *W. tenebrosa* Britton, 1995, *W. vicina* Britton, 1995 and *W. williamsi* Britton 1995). *Watkinsia incendiala* **sp. n.** falls within the second group and, given the absence of apical spurs on the metatibiae, close to *W. macrops* from 'New South Wales' and *W. megalops* from Eungella, central Queensland (Fig. 6). As only the female of *W. macrops* is known, it is difficult to compare it with the male of *W. incendiala* **sp. n.** However, the female of *W. macrops* is much larger (6.5 versus 4.7–4.9 mm long) and it has dark metallic green metafemora rather than yellow-brown ones of *W. incendiala* **sp. n.** Males of *W. incendiala* **sp. n.** and *W. megalops* are easily separated by the very large eyes and consequent narrow frons of the latter compared with the moderately large eyes and wider frons of the former (compare Fig. 2 with Britton 1995, Fig. 14 or Weir *et al.* 2019, Plate 66G). Males of the two species also have characteristically shaped parameres (compare Fig. 4 with Britton 1995, Fig. 23) and metatarsal claws (compare Fig. 3 with Britton 1995, Fig. 4), and those of *W. megalops* have the pronotum and elytra more brightly coloured (compare Fig. 2 with Weir *et al.* 2019, Plate 66G).

Fig. 6. Known collection localities of *Watkinsia* spp. in eastern Australia. *Watkinsia macrops* is known only from the unspecified locality of 'New South Wales'.

Watkinsia incendiala **sp. n.** can be incorporated in Britton's (1995) key by deleting couplet 7 and inserting the following:

7(4) Hind femora (at least in females) dark metallic green; New South Wales ..... *W. macrops* (Lea)

Hind femora (at least in males) yellow-brown to red-brown central and south-central Queensland 8

8(7) Males with eyes very large, almost hemispherical (Britton 1995, Fig. 14), width of head including eyes 4.2 times width of frons between eyes; elytra brilliant shining, metallic green, blue or purple; parameres as in Britton 1995, Fig. 23; Eungella, central Queensland ..... *W. megalops* Britton

Males with eyes moderately large, more elongate (Fig. 2), width of head including eyes 1.9 times width of frons between eyes; elytra shining dark brown with copper-green reflections (Figs 1, 2); parameres as in Figs 4, 5; Bulburin, south-central Queensland ..... *W. incendiala* **sp. n.**

The occurrence of *Watkinsia* spp. in restricted, high-altitude, wet-forest areas of eastern Australia is consistent with climatic warming from the Cenozoic through to the early Pleistocene that has resulted in an archipelago of refugia for many closed-forest groups along the eastern coast, separated by sometimes vast areas of drier open woodland/grassland (Bryant and Krosch 2016 and references therein). Typically, the general expectation for these closed-forest taxa is that these barriers interrupted gene flow among bisected refugia, driving divergence of disjunct populations. Thus, we have species of *Watkinsia* restricted to 'islands' along the eastern coast. In terms of Köppen-Geiger climate classification (Beck *et al.* 2018), these are areas of Cfa (humid subtropical) surrounded by areas of Cwa (warm humid subtropical) near Mackay and areas of Cfb (temperate oceanic) within areas of Cfa further south.

None of the *Watkinsia* spp. appear to have been collected at light but have been collected in pitfall, yellow-pan and flight-intercept traps, on flowers or in flight during the day (additional records in Britton 1995). Diurnal activity appears characteristic of the three genera of Diphucephalini.

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FIRST ACCOUNT OF THE LIFE HISTORY OF THE HAWKMOTH *EURYPTERYX MOLUCCA* C. AND R. FELDER, 1874 (LEPIDOPTERA: SPHINGIDAE: MACROGLOSSINI)

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Abstract

The final instar larva and pupa of *Eurypteryx molucca* C. and R. Felder, 1874 are described for the first time, together with aspects of the species' biology from observations of a larva found on Dauan Island, Torres Strait, Queensland. The larval foodplant is Chain Fruit, *Alyxia spicata* R. Br. (Apocynaceae). Comparison is made with the larva of *Eurypteryx bhaga* (Moore, [1866]) from South-East Asia, the only other *Eurypteryx* C. and R. Felder, 1874 species for which any life history detail is currently known.

Keywords: Dauan Island, Torres Strait, South-East Asia, *Eurypteryx bhaga*

Introduction

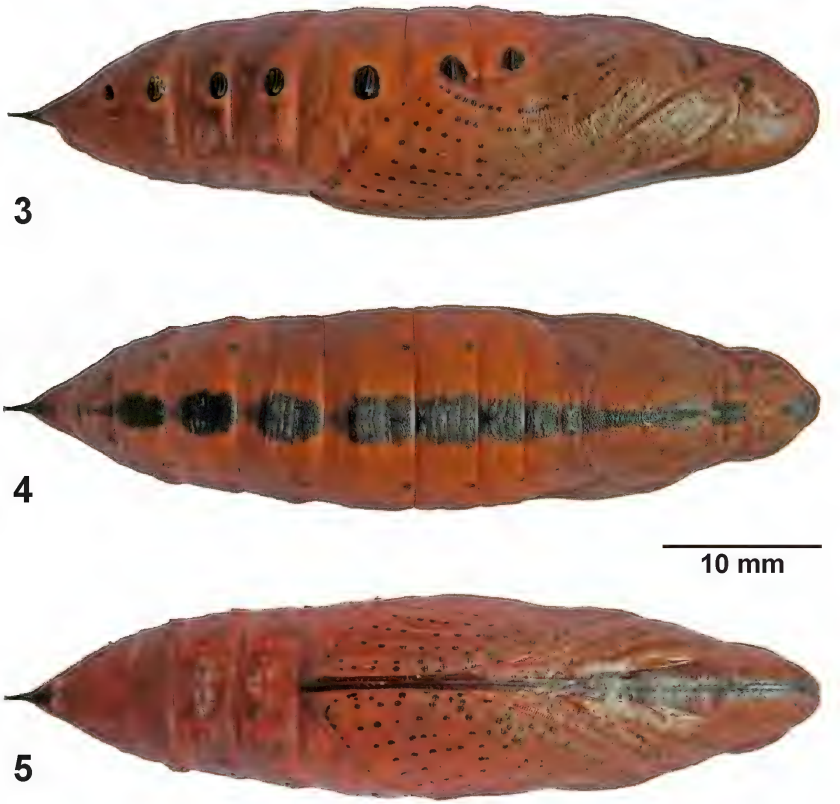
The genus *Eurypteryx* C. and R. Felder, 1874 currently contains eight species (Kitching *et al.* 2018a, 2018b; Moulds, Tuttle and Lane 2020) together having a distribution ranging from northern India through South-East Asia to New Guinea and northern Australia. Currently only the immature stages of *Eurypteryx bhaga* (Moore, [1866]) are known, with the larva and pupa illustrated by Eitschberger and Ihle (2014). They recorded the foodplant as *Alstonia scholaris* (L.) R. Br. (Apocynaceae), a foodplant also recorded by Diehl [1982] and Dupont and Roepke (1941). The final instar larva and pupa are also illustrated on the website "Sphingidae of the Eastern Palaearctic" by A.R. Pittaway and I.J. Kitching.

Eurypteryx molucca C. and R. Felder, 1874 is a rare species found in the Philippines, Waigeu, the northern Moluccas and New Guinea (Moulds *et al.* 2020), and currently known in Australia from a single male specimen collected on Boigu Island in northern Torres Strait, Queensland (Lachlan 1988, Moulds *et al.* 2020). During a visit to Dauan Island in March, 2021 one of us (MH), collected a final instar sphingid larva (subsequently identified as the unknown larva of *E. molucca*) at the summit of Mt Cornwallis, feeding on the large vine Chain Fruit, *Alyxia spicata* R. Br. (Apocynaceae) (det. Garry Sankowsky, Tolga). *Alyxia spicata* is known from New Guinea and the northern Australian tropics. This larva was reared through to adult thus confirming its identity as *E. molucca*.

Life history observations

Description of last instar larva (Figs 1, 2). Green dorsally and bluish white to pale blue laterally and ventrally, in varying shades. Dorsally light green paling towards midline (the midline itself darkened from internal organs), the green extending from prothoracic shield to caudal horn; a narrow subdorsal dark green border from prothoracic shield to base of caudal horn forming margin between

Figs 1, 2. Last instar larva, *Eurypteryx molucca* on its host plant. (1) dorso-lateral view; (2) dorsal view.



Figs 3–5. Pupa of *Eurypteryx molucca*. (3) lateral view; (4) dorsal view; (5) ventral view.

dorsal green shading and lateral bluish white region, its upper margin diffused, its lower margin clearly defined and scalloped by body folding, giving a saw toothed appearance; laterally white immediately adjacent to the green dorsal colouring, diffusing into a prominently pale bluish lateral region that darkens ventrally. Prothoracic shield pale blue. Spiracles white, minutely capped back dorsally and ventrally. Head without markings, very pale green. True legs a mixture of black and pale grey markings; ventral prolegs, claspers and anal plate all pale blue, similar to adjacent body.

Caudal horn light yellowish brown; robust, about 5.5 mm long; straight and almost parallel-sided for most of its length with distal portion tapering to a point; with many, very small, conical tubercles, these similarly coloured to horn, each with a very fine seta about as long as tubercle.

Length at maturity about 78 mm. Width of head capsule 5.1 mm. Duration unknown.

Description of pupa (Figs 3–5)
Mid to dark brown with black markings; surface with a slight or dull gloss. Dorsal midline with a broad black fascia from pronotum to abdominal segment 8, parallel-sided on pronotum, narrowing around mid length on mesonotum, broad on metanotum, broadest on abdominal segments 1–7 but broken between segments 4 and 5, 5 and 6, and 6 and 7, on segment 8 small and tapering posteriorly; a subdorsal row of small black spots, one per segment on thoracic and abdominal segments 1–8, all located near the anterior margin of the segment and some barely visible. Thorax and abdomen finely rugose at x25; the abdomen without small circular pits (foveolate). Forewings with venation highlighted by rows of small black spots irregularly spaced along length of veins. Abdominal spiracles boldly marked black. Head with a black mark on anterior vertex, broad on its anterior half, narrow on its posterior half, and a few small, indistinct, black spots anterior of eyes; eyes with an irregular black patch. Proboscis extending a little anterior of vertex, reaching to apices of forewings, not keel-shaped, its midline and distal half black. Legs and antennae with a few small black spots similar to those on wing veins.

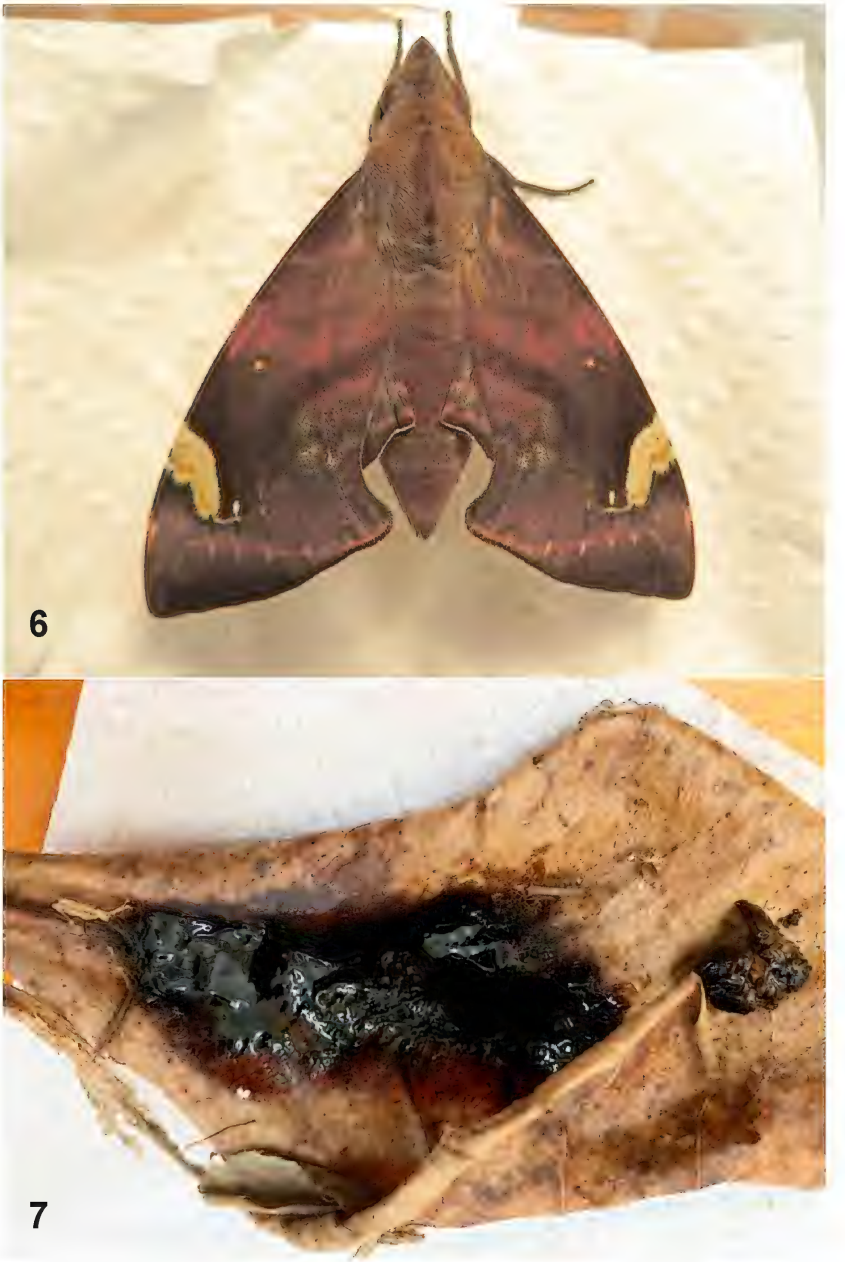
Cremaster black; long and slender, conical and gently tapering throughout its length; surface with very fine longitudinal, irregular folding; terminating in a pair of minute short spines directed laterally in a T-shape; not cavernous ventrally and barely grooved along ventral midline.

Length 52.5 mm. Width at widest point 13 mm. Duration 24 days.

Discussion
The last instar larva of *E. molucca* differs from that of *E. bhaga* in having no clearly defined white stripe separating the upper green dorsal part of the larva from the lower bluish white area, whereas *E. bhaga* has a pure white and clearly defined stripe. The caudal horn also differs, being light yellowish brown and straight in *E. molucca,* but blue with a little white and curved in *E. bhaga*.

The pupa of *E. molucca* differs from that of *E. bhaga* in having far less black, especially on the wings that in *E. molucca* are largely brown but in *E. bhaga* are clearly black. The spiracles are boldly highlighted black in *E. molucca* but in *E. bhaga* the spiracles are not highlighted any more so than other areas of the body. The cremaster differs significantly in shape being long and sender and tending linear in *E. molucca,* whereas *E. bhaga* lacks the linear extension and tends to be triangular in dorsal view.

The only two known larval hostplants recorded for *Eurypteryx* both belong to the Apocynaceae. however this does not imply that larvae of other species in this genus would be restricted to feeding on Apocynaceae. The closely related genus *Daphnis* Hübner [1819] also contains several species whose larvae exclusively feed on Apocynaceae, but there are several other species of *Daphnis* whose larvae feed on other unrelated plant families (Moulds *et al.* 2020). As this life history



Figs 6, 7. (6) Adult female of *Eurypteryx molucca* bred from the larva; (7) the blackish liquid as it was contained in the leaf bowl.

account is the first for *E. molucca*, its habitat remains unclear at this stage. The larval foodplant *A. spicata* is a huge vine that climbs into the rainforest canopy.

Larval pupation

After completing its feeding cycle the *E. molucca* larva turned a light brownish colour overall and left its foodplant to wander for a short period along the ground before commencing to construct a cocoon largely comprising silked-together dead leaves and debris on the surface of the ground. This cocoon was well constructed, sealed and effectively water proof, about 9 cm long x 5 cm wide x 5 cm high, and silked to a large dead leaf base lying on the ground. The cocoon structure was quite dry.

The cocoon was partially opened after three days for observation. The larva was still pre-pupal at that stage, and was found to be lying in a pool of dark brown (almost black) thick sludge-like liquid (see Fig. 7). This liquid was confined to the bottom of the cocoon and covered approximately 60% of the larval body, including covering some spiracles, legs, and the head, but did not appear to offer any harm to the pre-pupal larva that was still able to move freely and twist its body when slightly disturbed by touching with a soft paint brush. We presume the liquid was expelled by the pre-pupal larva, as occurs frequently with large sphingid larvae prior to pupation. The quantity of liquid seems to have been accentuated by its retention in the bowl-shape leaf at the base of the cocoon which prevented the liquid from dispersing. The dark colour of the liquid is unusual for a sphingid and may result from the toxic properties of the foodplant. As a precaution the pre-pupal larva was removed from the liquid and most of the liquid removed from its body as well as the cocoon base, before being returned to the cocoon. Pupation occurred on the fourth day after constructing the cocoon, thus taking five days from construction of the cocoon to pupa.

After a further period of 24 days a female *E. molucca* emerged from the cocoon at approximately 8 pm, climbed an adjacent twig and successfully expanded her wings over a period of approximately one hour; thereafter she remained motionless for a further two hours prior to preparation for flight (Fig. 6). This is the first record of a female *E. molucca* from Australia (in DAL coll.), the only other record being of a single male (Lachlan 1988).

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ACRAEA TERPSICORE (LINNAEUS, 1758) (LEPIDOPTERA: NYMPHALIDAE: HELICONIINAE) IN TORRES STRAIT, QUEENSLAND

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Abstract

Acraea terpsicore (Linnaeus, 1758) is newly recorded from Waiben (=Thursday) Island, Torres Strait, the species previously known only from Ngurapai (=Horn). Larvae of *A. terpsicore* are recorded from Ngurapai (=Horn) feeding on *Passiflora foetida* L. (Passifloraceae) (a variety with hirsute leaves and stems). On Ngurapai, the butterfly was abundant especially in waste areas in the drier parts of the island. A dispersal rate for the butterfly (estimated in the literature to be 315 km/yr), predicted the butterfly to arrive on Ngurapai in April 2016, a time very close to the first observation of the butterfly in February 2016. Based on the distribution of *P. foetida* it is highly likely that the butterfly already occurs on other Torres Strait islands.

Keywords: Tawny Coster, Thursday Island, Horn Island, invasive butterfly

Introduction

Much has been reported on the recent invasion of *Acraea terpsicore* (Linnaeus, 1758) into Australia and its movement across the northern half of the country (Sanderson *et al*. 2012, Braby *et al*. 2014, Moss and Hendry 2021). The first record of the butterfly in Queensland was on Ngurapai Island in February 2016 (Ham 2020), and subsequently in 2018 and 2020 (Ham 2020). On mainland Queensland, it was first observed a little later near Kowanyama in April 2016 (Wilson 2016), and in November 2020 was recorded at Coffs Harbour in New South Wales (Shakespeare 2021). In April 2021, I undertook a butterfly survey of Ngurapai Island and during this time I observed *A. terpsicore* on the island, in addition to recording it for the first time on nearby Waiben (=Thursday) Island. Additionally, in this current work, I record its host plant on Ngurapai Island, and discuss its relative abundance on the island and theorise its potential movements north through the Torres Strait islands.

Field observations

On Ngurapai Island *A. terpsicore* was observed across most of the island, particularly in open disturbed areas, along roadsides and in waste areas that had previously been burnt. In addition, the butterfly was more prevalent in the drier areas of the island, especially on the eastern side in the area adjacent to and on Horned Hill (-10.595°, 142.318°) (96 m), which also has large areas of disturbance. The butterfly was much less prevalent on the western side of the island in the township of Wasaga. Many larvae of *A. terpsicore* (Figs 1, 2) were observed, in the vicinity of Horned Hill, feeding on a form of *Passiflora foetida* L. (Passifloraceae) with hirsute leaves and stems (Fig. 3). The butterfly was also observed along the margins of savannah woodland but was largely absent within these woodlands. Around Horned Hill, in the disturbed lowlands, adult butterflies were very abundant, especially males. Although males were

observed patrolling the summit of the hill (Fig. 4) between 10.00 and 11.30 h, they were not exhibiting hilltopping behaviour at that time. Across the island, butterflies (*A. terpsicore* and other species) were frequently observed in modified areas feeding on blossom of *Stachytarpheta cayennensis* (Rich.) Vahl (dark blue snakeweed) (Verbenaceae).

On Waiben Island, the butterfly was restricted to the area on the summit of Milman Hill (-10.578°, 142.226°) (98 m) where it is relatively dry and quite disturbed. On Milman Hill, females of *A. terpsicore* were observed visiting plants of *P. foetida*, the same variety as that on Ngurapai Island. *Acraea terpsicore* was locally common on the hill and appeared to be restricted to the summit area where *P. foetida* grew. Butterflies were also observed visiting the blossom of *S. cayennensis*.

Discussion

In accord with the observations of Braby *et al*. (2014), *A. terpsicore* on Ngurapai and Waiben Islands is primarily restricted to disturbed or waste areas where the larval host plant, *P. foetida*, grows. In contrast to the findings of Braby *et al*. (2014) in the Top End, *P. foetida* appeared to be the primary larval hostplant on the two islands as many larvae were observed on this host on Ngurapai. While *Hybanthus* Jacq. (Violaceae) species are known larval host plants for the butterfly, *Hybanthus* is not recorded from Ngurapai. *Hybanthus enneaspermus* (L.) F. Muell. may occur on the island, as it is known from nearby Cape York and Waiben Island, and from Badu Island approximately 50 km to the north of Ngurapai (Atlas of Living Australia 2021a).

Braby *et al*. (2014) first recorded the incursion of *A. terpsicore* at Cox Peninsula in the Top End in April 2012, before it rapidly invaded areas to east, south east, and west into Western Australia. Based on its dispersal over a 14-month period, Braby *et al*. (2014) estimated that the butterfly was dispersing at an average rate of 315 ± 56 (SE) km/yr. The distance between Cox Peninsula, NT and Ngurapai Island (directly ENE) in Torres Strait is approximately 1280 km. Based on the above dispersal rate as estimated by Braby *et al*. (2014) and assuming that the dispersive wave originated from Cox Peninsula in April 2012, a predicted date for the butterfly's arrival on Ngurapai Island would roughly be April 2016. This date is not too different to when the species was first recorded on Ngurapai Island in February 2016 (Ham 2020), suggesting that the estimated dispersal rate of Braby *et al*. (2014) was reasonably accurate.

It is currently unknown how far through Torres Strait *A. terpsicore* has invaded but in January 2021 it was not observed on Dauan Island in the very north of the strait. As yet, it is unrecorded from Papua New Guinea. Based on its propensity to feed on *P. foetida*, as recorded here, it is highly likely that the butterfly will be found on other Torres Strait islands where *P. foetida* is known. Based on current records (Atlas of Living Australia 2021b), the plant occurs on almost all inhabited islands of Torres Strait, as well as Papua New Guinea.

Figs 1–4. (1, 2) Larvae of *Acraea terpsicore* on *Passiflora foetida*; (1) 4th instar larva; (2) 3rd instar larva. Note the hirsute leaves and stems of host plant; (3) *P. foetida* with flower buds; (4) Looking north from Horned Hill (All figures Ngurapai Island).

The related *A. andromacha andromacha* (Fabricius, 1775) appears to be infrequently observed in Torres Strait, and is known from just three islands, *viz.* Muralug (=Prince of Wales), Moa and Waiben Islands (Waterhouse and Lyell 1914; Common and Waterhouse 1981; Braby 2000), with no further observations of the butterfly recorded (unpublished data) since the time of Braby (2000). During my time spent on Ngurapai and Waiben Islands in April 2021 (collectively 5 d), *A. a. andromacha* was not observed on either island. This might not be surprising, based on the relatively scant records of the species in Torres Strait. Braby (2000) theorised that in favourable years, *A. a. andromacha* can extend its range in a southerly and inland direction. In Torres Strait, such extension may also be the case, where it may move north, with the species not permanently established on the islands. Now that *A. terpsicore* is firmly established on Ngurapai and Waiben Islands, and likely occurs on more Torres Strait islands, time will tell how it will interact with *A. a. andromacha* in Torres Strait.

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FIRST RECORD OF *PSEUDOCLANIA* BETHUNE-BAKER FROM AUSTRALIA (LEPIDOPTERA: PSYCHIDAE: OIKETICINAE)

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Abstract

The species *Clania photidias* Meyrick and Lower, 1907 is here recognised as *Pseudoclania photidias* (Meyrick and Lower, 1907) **comb. n.** and is diagnosed and redescribed and compared with the Indonesian and Papua New Guinean fauna. The new combination represents the first time the genus *Pseudoclania* Bethune-Baker, 1915 has been recorded from Australia.

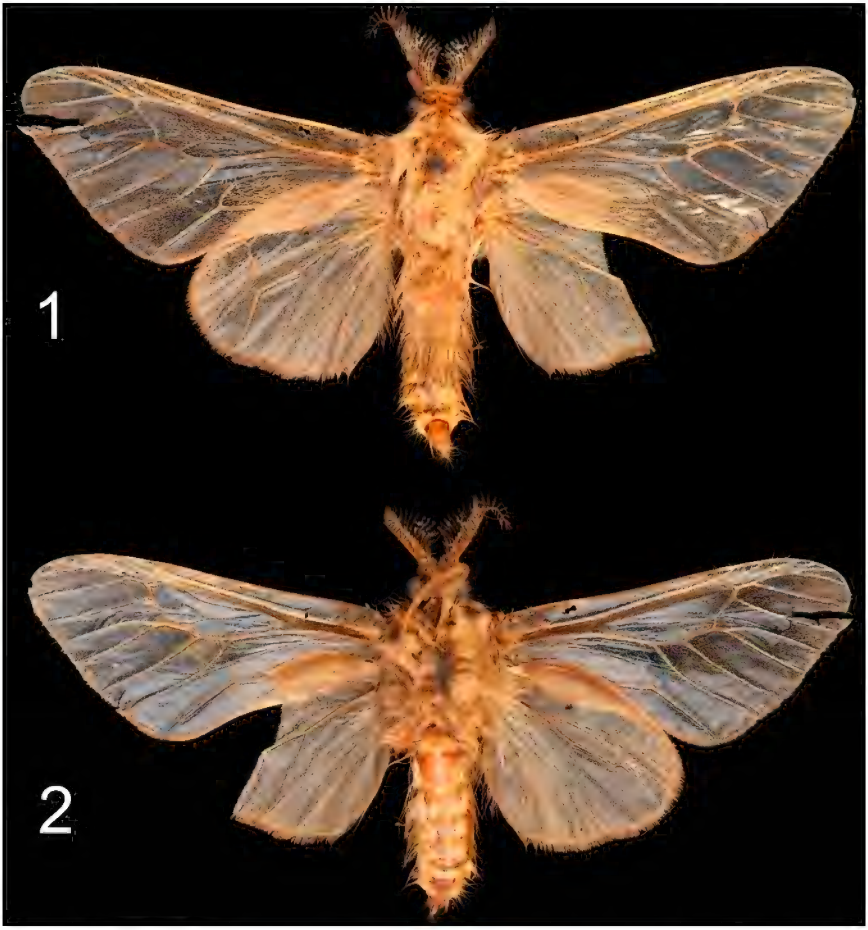
Key words: Case moth, bagworm, *Pseudoclania photidias,* redescription

Introduction

Pseudoclania Bethune-Baker, 1915 was described for the single species *P. dinawaensis* Bethune-Baker, 1915, a common species endemic to mainland New Guinea (Papua New Guinea and Indonesian West Papua). Recently, four new species were described by Sobczyk (2020) from West Papua and the Moluccas, as part of a revision of the Oiketicinae of New Guinea and surrounding islands.

The genus *Pseudoclania* is distinguished from superficially similar clear-winged Australian genera *Hyalarcta* Meyrick and Lower, 1907 and *Hyaloptila* Turner, 1947 by the presence of a forked medial vein in the forewing cell in *Pseudoclania,* which is unforked in the other two genera, and from *Elinostola* Meyrick and Lower, 1907 by the absence of forewing vein Rs_5 in *Pseudoclania*. Additionally, *Elinostola* consists of darker species with much smaller wings (wingspan 25 mm), with a varying degree of scaled or non-scaled wings. *Pseudoclania* differs from *Eumeta* Walker, 1855 and *Clania* Walker, 1855, in that the forewings are heavily scaled in those genera, or in the species with semi-transparent wings, dark brown or black scales are present along the primary forewing veins. Additionally, both genera lack spines along the length of the forelimb tibia, structures present in *Pseudoclania.* Papuan members of the largely Eurasian and Afrotropical genus *Acanthopsyche* Heylaerts, 1881 have hindwing veins M_2 and M_3 separate, whereas they share a common stalk in *Pseudoclania*. The similarity between *Amatissa* Walker, 1862 and *Pseudoclania* was commented on by Sobczyk (2020), however it was noted by him that *Pseudoclania* has a prominent lateral protrusion of the tegumen, which is not present in *Amatissa.* Generally, *Amatissa* has the wings thickly scaled whereas in *Pseudoclania* they are scaled only lightly on the basal area of the forewing, with heavier scaling present on the hindwing. The exception to this is *A. papuana* Sobczyk, which has the wings unscaled. Interestingly, several live specimens of *Amatissa* were photographed from Yorkeys Knob, Queensland (D. Funnel, *pers. comm.*) which differ from *A. fuscescens* (Snellen) from Sulawesi and New Guinea by having the forewings narrower and more triangular, however Australian specimens are yet to be collected and identified.

The species *Clania photidias* Meyrick and Lower, 1907 was described eight years before *Pseudoclania* was named. The placement of this species within the genus

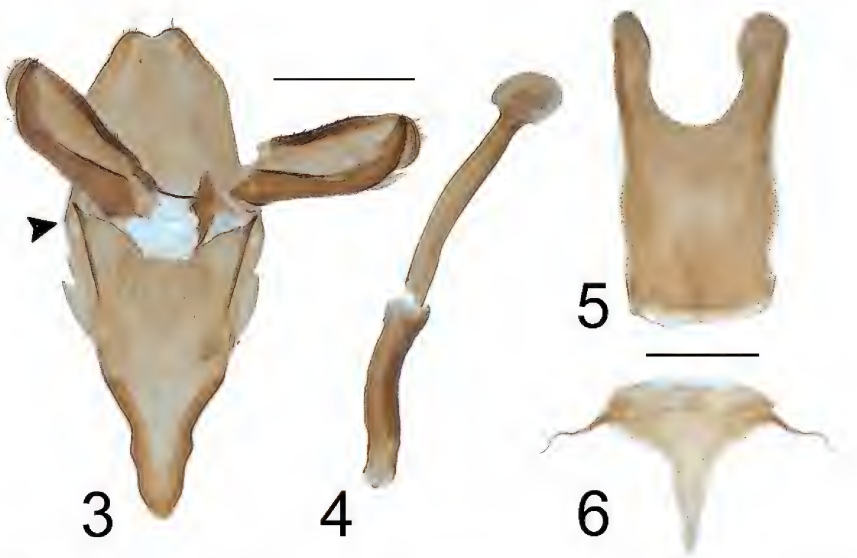


Figs 1, 2. Holotype male of *Pseudoclania photidias* (Meyrick and Lower, 1907) **comb. n.**: (1) dorsal view; and (2) ventral view.

Clania by Meyrick and Lower (1907) was questioned by Nielsen and Edwards (1996) who removed this species from *Clania* but did not place it within an available genus. The aim of this present work is to redescribe this species and provide evidence to support the hypothesis that this species is better placed within *Pseudoclania.*

Materials and methods

Terminology for morphology follows that of Robinson and Nielsen (1993), Arnscheid and Weidlich (2017), and Beaver (2020). Specimen label data are presented with a '/' indicating a separate second or third specimen label.



Figs 3–6. Male genitalia of *Pseudoclania photidias* **comb. n.**: (3) genitalia complex, (4) phallus, (5) sternite VIII, (6) tergite VIII.

Dissections of genitalia were performed by removing the end or entire abdomen and left legs of male specimens and heating in 10% KOH solution for 5–8 minutes before being cleaned in distilled water and stored in 70% ethanol. Dissection numbers used herein (e.g. EPB-035) refer to a single ethanol vial that contains both genitalia and abdominal sternites, and is stored in the same institution as the corresponding pinned material.

Dissections were imaged in an alcohol solution using a Leica imaging system comprised of a Leica binocular microscope with Leica DFC 500 camera and LAS Core software. Images of adult specimens were taken using a Canon EOS camera, with a Canon EF 100 mm 1:2.8 macro lens and Canon Speedlite Transmitter and Speelite 430 EX11 flashes. The images were then stacked using Zerene stacker software.

All specimens examined are within the South Australian Museum entomology collection, Adelaide (SAMA).

Systematics

Psychidae Boisduval

Oiketicinae Herrich-Schäffer

***Pseudoclania photidias* (Meyrick and Lower, 1907) comb. n.**

(Figs 1–10)

Clania photidias Meyrick and Lower, 1907: 199.

Unplaced genus *photidias* Nielsen and Edwards, 1996: 35.

Figs 7–10. Live habitus of resting male *Pseudoclania photidias* **comb. n.** at MV light from Shannonvale, Qld.: (7) 1 July 2017, (8) 27 July 2017, (9) 18 August 2017, (10) 29 July 2016. (photos courtesy of D. Funnell).

Type material. Holotype ♂, QUEENSLAND: Cairns, Q [Barron Falls, G. Barnard], 4213 / SAMA database no. 31-000292 / C. photidias TYPE M+L (in SAMA).

Additional material examined. 9 ♂♂, QUEENSLAND: 1 ♂ Lake Barrine, 19 September 1938, N.B. Tindale / SAMA database no. 31-017609 / EPB Dissection ID EPB-035. 1 ♂ Cairns, coll. Lower / SAMA database no. 31-017610 (both in SAMA). 7 ♂♂, Shannonvale, approx. 9 km S of Mossman, D. Funnell, with dates 25 July, 27–29 July, 2 August 2016, and 1 July, 18 August 2017 (all living specimens examined by photograph, such as Figs 7–10)

Diagnosis. This species is distinguished by the fringe of dark brown scales along the hindwing margin, and by the hindwings being more heavily scaled than the forewings. *Pseudoclania photidias* is readily distinguished from the New Guinean *P. dinawaensis* as the body is heavily clothed with black scales in that species, with the hindwing largely free of scales medially and towards

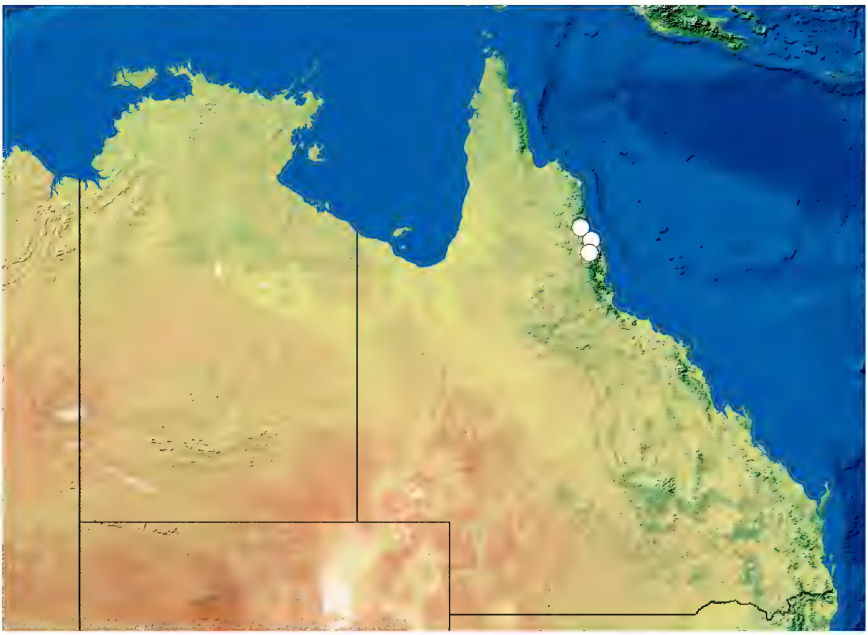


Fig. 11. Distribution of *Pseudoclania photidias* **comb. n.**

the apex. *Pseudoclania incana* Sobczyk and *P. fragilis* Sobczyk both have the forewings heavily scaled, whereas in *P. photidias* they are transparent except basally. *Pseudoclania bacanensis* Sobczyk is distinguished from *P. photidias* in a similar way, in that *P. bacanensis* has the forewing apex and termen lightly scaled with only the medial area unscaled. *Pseudoclania obiensis* Sobczyk is similar to *P. photidias*, however the latter species has the hindwing more heavily scaled, and the hindwing fringe more distinct. The genitalia differ from other *Pseudoclania* species particularly in the shape of the vinculum and saccus, which in *P. photidias* is sinuate along the lateral margins, and uniform in the other species except for *P. obiensis,* a species otherwise clearly distinguished by the deep concavity on the lateral margin of the uncus, which is convex in *P. photidias*.

Redescription. Male (Figs 1, 2, 7–10). *Measurements: wingspan* 31–37 mm, *forewing* 15–17 mm, *hindwing* 10–11 mm.

Head. Frons and vertex covered in dense cream-grey scales. Labial palps, with single palpomere, ovoid, slightly longer than wide, vom Rath's organ absent. Proboscis absent. Scape broad, flattened ovoid. Pedicel rectangular, ⅓ general size of scape. Both covered in long, white-cream piliform scales. Antenna with 29 flagellomeres, bipectinate to apex. Dorsal aspect of flagellomere scaled for basal ¼. Rami heavily ciliated, longest at basal ¼, approx. 9x the width of the flagellomere at widest.

Thorax. Light cream-grey dorsal and ventral. Two tarsal and two tibial spines on all legs, tibia and tarsi heavily spined along ventral length, spines confined to rings around posterior of all tarsomeres. Hind tibia and tarsi less heavily spined than mid and fore limb. Arolium flattened, ovoid. Epiphysis absent.

Wings. Scale type mostly class 1–2. Forewing triangular, costa straight, apex rounded, termen straight, dorsum slightly concave towards tornus, convex anteriorly. Rs2, Rs3 and Rs4 share common stalk, Rs5 absent. M2 and M3 arise from close to discal cell. CuP and A merged. Surface generally hyaline, light brown-grey scales in basal area around CuP+A, at tornus, weakly at apex, and along costa. Ventral as for dorsal, more heavily scaled medially. Hindwing rounded, costa convex, apex rounded, termen medially concave, dorsum convex. Frenulum long, brown. Sc, R, and Rs1 merged, M2 disconnected, 3 M veins, 3 A veins. Surface light brown-grey, semi-transparent centrally, fringe scales dark brown, piliform scales along dorsum and in basal area. Ventral as for dorsal.

Pregenitalia abdomen. Telescopic, light brown-grey, sternites and tergites reddish brown. Sternite VIII (Fig. 5) with paired anterior apophysis; apexes rounded. Tergite VIII (Fig. 6) somewhat 'T' shaped, posterolateral corners elongate, hair-like, lateral margins tapering to point.

Genitalia. (Figs 3, 4). Saccus narrow, posterior margin broad, shallow, concave. Lateral margins heavily sclerotised, sinuate, two concavities towards anterior apex. Vinculum with vincular arms straight, heavily sclerotised on inner margin with saccus, outer margin becoming membranous. Tegumen outer margin subtly concave. Uncus broad, higher than wide, lateral margin convex, posterior apex bifurcate, setose on dorsal aspect. Gnathos fused with uncus. Transitellar arms heavily sclerotised, anterior margin slightly convex, posterior triangular. Juxta absent. Valvae elongate, apexes bifurcate to two subequal lobes, ventral lobe hooked, blunt at apex, dorsal aspect and inner dorsal margin setose with short irregular spines. Phallus elongate, ventrally concave, dorsally convex, ductus ejaculatorius smooth, vesica globular, smooth.

Variation. Specimens vary in vibrancy of light brown colouration, living specimens with forewing veins at costa green, elsewhere dark brown.

Female. Unknown.

Distribution, biology and phenology. Pseudoclania photidias is known only from the Wet Tropics of north-eastern Queensland (Fig. 11) where it has been collected from Barron Falls, Kuranda; Lake Barrine; and Shannonvale. It has been attracted to MV lights at night (Figs 7–10) between 1 July and 18 August. Females, as well as larvae and larval biology, are unknown.

Discussion

As outlined in the introduction, *Pseudoclania* can be distinguished from *Clania* by two characteristics, (1) forelimb tibia with spines present along entire length, and (2) forewings largely hyaline and with greatly reduced scale cover. In contrast,

the foretibia in *Clania* is smooth, and the forewings are heavily scaled. It is due to these two differences that *C. photidias* is reassigned to *Pseudoclania*, thereby preserving monophyly of *Clania.*

Little modern taxonomic work has been conducted on the genera of Oiketicinae, and further investigation is needed to unambiguously delimit some of the Australian genera, and to address the many new species awaiting description. The only predominately Australian oiketicine genus to undergo a modern taxonomic revision is *Metura* Walker, 1855 (Beaver 2020), a genus with somewhat low species diversity in comparison to many other genera in this subfamily. The recognition of *P. photidias* brings the number of *Pseudoclania* species to six, and represents the first report of this genus in Australia. Additional specimens that approximate *Pseudoclania* in general appearance are known from northern Australia and are housed in ANIC (*pers. obs.*), however further study is required to determine if these represent known or undescribed taxa.

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RANGE EXTENSION FOR *TRAPEZITES PETALIA* (HEWITSON, 1868) (LEPIDOPTERA: HESPERIIDAE: TRAPEZITINAE) IN QUEENSLAND

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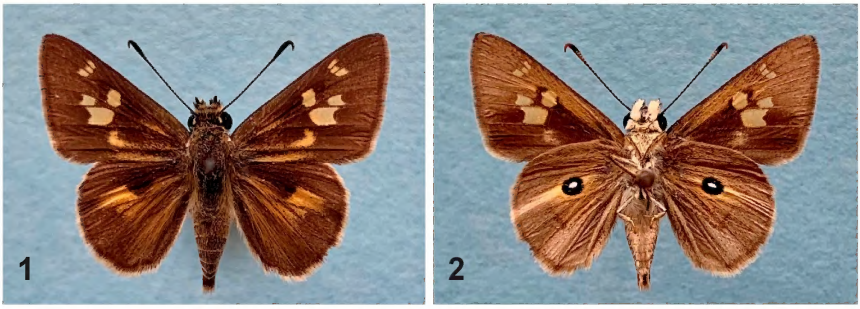
Abstract
The Black-ringed Ochre, *Trapezites petalia* (Hewitson, 1868) is recorded from Scrubby Creek, Portland Road, Cape York Peninsula, Queensland, extending the known range of the butterfly a further 500 km north-north-west of Kuranda.

Keywords: near Lockhart River, ridgeline, open eucalypt forest

Discussion and observations
The Black-ringed Ochre, *Trapezites petalia* (Hewitson, 1868) (Figs 1, 2), is endemic to eastern Australia occurring sporadically from Kuranda, Queensland in the north to Ulladulla, New South Wales in the south (Common and Waterhouse 1981; Braby 2000). During successive surveys of the Kutini-Payamu (Iron Range) National Park near Lockhart River one of us (CEM) collected two males at Scrubby Creek on Portland Road (-12.6728° 143.3367°) during the periods 24–27 July 2017 and 3–7 June 2021. These records extend the known range of the butterfly a further 500 km north-north-west of Kuranda, Queensland. On both occasions the butterfly was encountered flying on a ridgeline in open eucalypt forest with a grassy understorey along with the Brown Ochre *Trapezites iacchus* (Fabricius) and the Small Orange Ochre *Trapezites heteromacula* Meyrick and Lower.



Figs 1, 2. Male *Trapezites petalia* from Scrubby Creek. (1) upperside; (2) underside.

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to conduct the surveys. The surveys were conducted under the Entomological Society of Queensland scientific permit numbers WITK15793015 and WITK18701717 respectively.

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